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The Training of Workers in Manufacture

I. Present Scope of Apprenticeship in the United States — Number of Apprentices in Various Industries—Importance of Apprentices in the Metal-Working Field

BY J. V. L. MORRIS

A ROUGH estimate, based on a study of the apprentice departments of about thirty manufacturing plants and the repair shops of several railroads, places the number of apprentices in such departments, where well organized, at approximately 10,000. It should be noted that this does not include the building trades, where, particularly in plumbing and bricklaying, there still remain some vestiges of apprenticeship.

From the figures given in Table II on the plants visited, some approximations may be made of the enrollment in the various trades. It will be seen

TABLE I. DATA FROM 1910 CENSUS

Apprentices in Iron and Steel Industries:	
Car and railroad shops	395
Ship and boat building	576
Iron foundries	2,619
Agricultural and implement factories	95
Automobile factories	1,096
Blast furnaces and steel rolling mills	1,313
Wagon and carriage factories	627
Other iron and steel factories	12,494
Total	19,215
Apprentices in printing and publishing establishments	11,376
Total apprentices	30,591
Total Number of Workmen at Above Trades:	
Blacksmiths	232,957
Machinists	460,784
Boilermakers	44,761
Other iron and steel workers	900,443
Toolmakers, die setters and die sinkers	9,243
Pattern and model makers	23,006
Compositors, linotypers and typesetters	113,538
Total	1,784,732

that about 60 per cent are to be found in the machinists' and toolmakers' trades. While adequate data is not available, there should here, however, be made a differentiation between the toolmakers and the all-round machinists, as it is usually recognized that only a small portion of the apprentice-trained machinists should be considered toolmakers. The relatively small number of a hundred odd patternmakers' apprentices should be noted. There are, of course, a considerably larger number than this under apprenticeship throughout the country as most shops recruit by that means.

What constitutes an electrician is not well defined. It may mean an inside wire-man, a general service mechanic on motor repairs and installation, an armature winder, an assistant at testing, or plant operator; so that little significance should be given to that column. Owing also to the large amount of technical information which should be acquired by those who have the capacity and who desire to rise, it is a field recommending a large utilization of either day or evening technical schools. The same remark holds in a general way as regards draftsmen.

As the 1920 census was not yet available at the time of writing, the figures in Table II should be compared with the data in Table I, available from the 1910 census.

In considering this data, the following factors should be kept in mind: In the census no distinction is made between the apprentice under an organized scheme for providing variety of experience and instruction, on the one hand, and the helper and inexperienced machine hand and operative without systematic training, on the other. Probably, for example, most of those in training as molders and blacksmiths should be classed as helpers. A very large number in iron and steel factories should probably also be considered as merely inexperienced machine hands. Also, it should be noted that there has been a very considerable reorganization of apprenticeship in the past ten years. In the railroad shops and in the boat-building industry, for example, there has been a decided increase in the number of apprentices.

The comparatively small number of toolmakers and patternmakers, 9,000 of the former and 23,000 of the latter, should also be contrasted with the half million classed as machinists, as the two former trades are outstanding examples where apprenticeship has survived because no adequate substitute has been found.

Approaching the matter from another standpoint, we can divide those employed in the metal-working trades under consideration into four categories:

(1) Initial production and toolmaking.
(2) Piece production, or single operations.
(3) Assembling.
(4) Repair or maintenance work.

(1) If no new designs were got out there would, of course, be no work for the patternmaker; but, as a matter of fact, all larger plants are constantly remodelling their products in the keen competition to produce the best article for the purpose. This requires the work of the patternmaker, diemaker, diesinker, etc. The toolmaker is also constantly in demand to provide the requisite tools. All these trades are of the skilled nature which we have come to associate with apprentice training.

(2) In actual quantity production, specialization is found to be so much more efficient in obtaining both output and quality that all-round training for stock production has practically disappeared. There are two types of workers in this field, however, who do need the general training. These are the supervisory force, such as the superintendent, foreman, sub-foreman, and inspector, and the substitute man, the one who can fill in at any machine. Naturally, if the latter has the

capacity to lead he may be expected to be promoted to the supervisory force when vacancies occur.

This category of "piece production" is by far the most numerous of all, and aside from the very limited number of foremen and substitute men just mentioned, is ordinarily recruited from the unskilled group by being taught one machine or process, after which the worker is recognized as belonging to the semi-skilled class.

Assembly and Maintenance

(3) Formerly assembling was considered a type of skilled work. Recent developments in the way of standardized products are making it possible to permit this work to be performed by unskilled workers who are taught to do just one or two operations, when the partially completed production passes on to another who, in turn, adds his one or two parts to the whole. Of course, if the product is intricate, the inspector may profit by the all-around training predicated by apprenticeship; but as a matter of fact his knowledge needs to be chiefly of the product inspected, which may often be quickly learned. Of course, there is much assembling of the old-fashioned type by building up the complete product where all-round capacity may seem desirable, and hence apprenticeship be urged. The facts are that the inexperienced men starting at this type of work are usually adults who, perhaps, slowly and clumsily work at it until they learn the knack of putting together completed parts, and of making the slight adjustments always necessary at the end of every fabricating process.

TABLE II. ENROLLMENT OF APPRENTICES

Type of Plant	Approx. No. Employees	Total No. Apprentices	Machinists and Toolmakers	Patternmakers	Electricians	Molders	Draftsmen	Miscellaneous
No. 1 electrical manufacturing	20,000	228	142	27	39	..	20	...
No. 2 electrical manufacturing	20,000	403	186	15	75	12	115	...
No. 3 electrical manufacturing	12,000	327	249	21	35	..	22	...
No. 4 electrical manufacturing	40,000	190	...	...	...	..	...	...
Rubber manufacturing	34,000	105	54	..	14	..	11	26
No. 1 automobile manufacturing	55,000	1,000	1,000	...	...	..	...	...
No. 2 automobile manufacturing	12,000	122	109	7	6	..	...	...
Abrasive machinery	3,000	7	7	..	..	..	...	...
Ordnance manufacturing	1,000	76	76	..	..	..	...	...
Rifles and specialties	12,000	116	116	..	..	..	...	...
No. 1 printing press manufacturing	4,000	55	55	...	...	..	...	...
No. 2 printing press manufacturing	5,000	168	160	5	1	2	...	5
Steel production	12,000	70	38	...	...	..	...	32
Recording machines	8,000	60	51	1	2	..	6	...
No. 1 machine tool manufacturing	5,000	50	48	2	..	..	...	...
No. 2 machine tool manufacturing	8,000	200	150	5	..	12	23	10
No. 3 machine tool manufacturing	1,400	89	89	...	...	..	...	...
Air brake manufacturing	4,500	30	26	2	..	2	...	...
Electrical instruments	900	15	15	...	..	..	...	...
Machinery manufacturing	1,200	40	37	3	..	..	...	...
Roller bearing manufacturing	4,500	38	38	...	...	..	...	...
No. 1 shipyard	12,000	243	88	14	12	..	16	113
No. 2 shipyard	16,000	400	...	...	...	..	...	...
Locomotive manufacturing	5,500	83	17	12	1	15	38	...
No. 1 railroad shops	.....	1,300	795	..	12	..	...	175
Boilermakers	.....	...	...	..	..	..	...	79
Sheet metal-workers	.....	...	...	..	..	..	...	234
Carpenters	.....	...	...	..	..	..	...	22
Blacksmiths	.....	...	...	..	..	..	...	13
Painters	.....	...	...	..	..	..	...	365
No. 2 railroad shops	.....	730	365	..	..	..	...	...
No. 3 railroad shops	.....	900	...	..	..	..	...	...
Printing plant	3,500	150	...	..	..	..	...	...
Estimated totals	500,000	7,225	4,500	114	200	43	251	1,074

(4) Finally, there is the maintenance work, which in a large number of cases seems to recommend the all-round mechanic for whose training apprenticeship is usually urged.

As a whole, then, accepting the estimate that there are approximately ten thousand apprentices in the fields investigated, the question naturally arises whether this is ample. Most manufacturers would answer in the negative. Usually the shortage of toolmakers is lamented, of the all-round mechanics for repair work and of suitable material for foremen. It should also be recognized that these plants studied are the outstanding examples of corporations which have introduced well-organized apprentice training. Many of their competitors make a practice of "stealing" the skilled mechanics they require. For example, the two automobile companies cited are among the few automobile concerns who have paid serious attentiton to apprentice training; and yet owing to their large amount of development work, of intricate assembling, and increased demands for foremen to supervise their expanding factories, most automobile manufacturers could use a far larger number of apprentice-trained mechanics.

Use Diamond Tools Carefully

By E. Ferber

How to properly use diamond tools seems to me to be so little understood that I think the following extract from the catalog of the Arthur A. Crafts Co., Boston, Mass., is worth passing along.

The most common evidences of careless use of diamond tools that are returned to the factory for resetting are: The overheating of the diamond; the nicking or grinding away of the setting by careless application to the wheel, thus exposing too much of the crystal; and the continued use of the diamond after the crystal has been worn to a broad, flat surface.

From an inspection of hundreds of diamonds so returned in every mode of setting we can safely say that the principal cause of trouble is overheating. This may be due to taking too heavy a cut, using a feed that is too fast, or may result from an inadequate supply of water, or no water at all, upon the tool. After the diamond has become worn down as above described the broad surface rubs rather than cuts and overheating is inevitable.

Like all other materials the diamond expands slightly when heated. Most grinding machine operators have seen the diamond rise to a red heat when truing a wheel, even under a liberal stream of water. The heat would not of itself injure the diamond but the expansion causes to be set up an enormous pressure against the rigid walls of the metal setting, which, because of the presence of the cooling liquid does not expand in conformity with the diamond, and thus a serious strain is induced in the structure of the crystal, tending to crack it.

If on the other hand the metal setting expands to some extent with the diamond, the continued expansion and contraction soon loosens the crystal in its setting, allowing it to vibrate under the action of the wheel, which vibration will sooner or later cause it to crack very easily.

Our advice to operators is, therefore, to take light cuts, exercising due patience and using plenty of water so that the diamond will never be overheated. When a diamond has become dull it should promptly be reset so that it may present new and sharp points to the work.

MODERN PRODUCTION METHODS

By
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of
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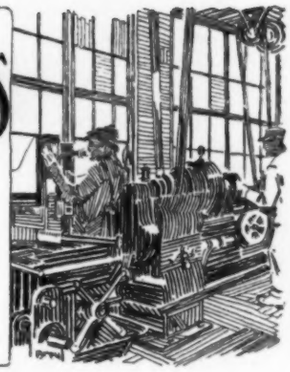


XXVI. Time Study on Automatic Machines

Quality of Labor Employed—Importance of Standardization in This Work—Rules of Procedure and an Example of Rate Setting

AUTOMATIC machines present some special problems in time study and rate-setting. Commonly, not much study has been given along these lines, for the thought has been that the automatic feature reduces the human element to a minimum. This is actually an added reason for making careful studies.

The quality of labor employed on this kind of work need not be high; in fact, most automatic machine operators know only how to operate one certain kind of machine, and frequently only one size. This means that the operations must be standardized as much as possible, accurate standard instructions developed and a careful scheme of supervision and inspection installed.

Standardization is the keynote for all automatic machine time study work. Possibly due to the fact that we are dealing with an automatic machine it is possible to establish standard speeds, feeds and methods which are applicable to practically all types of work. On an automatic machine, the human element is comparatively unimportant. Supposing the machine to be in good condition, the tools will always feed evenly, or at least the same on each piece, and the movements of the machine will take place with the same amount of shock each time. This is very different from hand operated machines where everything depends on a human operator. While there are exceptions, this is generally true.

Having established sufficient standards, it is a comparatively easy matter to establish rates and, consequently, costs on any part on which an estimate may have to be made, laying out what each tool is to do, so that the tool designer will only have to design tools which will fit in with the layout already made. Instruction sheets, set-up cards and tool lists may all be made up at the same time long before the job is ready to work.

I shall not try to cover each automatic machine on the market, but shall outline the methods which were installed in a large automatic department in which there were several different makes of machines with a multitude of different sizes. The same general procedure was followed in setting standards on each class of machines.

It is also beyond the scope of this article to attempt to outline the various types of work which each machine is particularly fitted to do. Some are admittedly designed for low speeds, heavy feeds and wide limits of accuracy, giving merely a roughing cut; others give practically any degree of accuracy desired, using high speeds and light feeds. This type will give a very fine finish to the work if desired.

One reason why automatic machines have not been generally the subject of time study work, is that their operation being automatic, the machine will, with proper attention, get out the desired number of pieces daily without an incentive.

Also the large amount of time needed to keep automatics in condition has been given as a reason for not subjecting them to time study. This loss of time, due to failure of machine or tools should be, however, a real reason for the establishment of a wage incentive, as will be fully explained later. Although the machines should, as a result of their automatic feature, get out a certain definite number of pieces per hour, they never seem to do it when there is no extra incentive. If the operator has not this incentive, it is very easy to allow a machine to "cut wind" for a few minutes before putting in a new bar of stock. Or, if he is working on one machine and another needs a slight adjustment, he will frequently shut down the second machine and continue working on the first, when just a few moments' attention would enable the second to go on producing good work.

With a proper incentive, the operator is inclined to keep his machines in better working condition by repairs or seeing that they are made before the breaks occur. The machines are watched more attentively, and slight breaks are prevented from developing into bad ones by immediately stopping the machine when the trouble starts. This reduces the machine repair cost and also the resulting delay.

When the study of the operations is made and the operators are trained to make their task, they are shown the fallacy of attempting to adjust their machines when the dimensions of the part being made vary a bit but are still well within the desired limits. Operators generally seem to feel that it is necessary to make adjustments when they are not really necessary. This frequently results in damaging tools or spoiling several pieces of the work before the machine is brought back to a working condition as good as that existing when the adjustment was started. As long as the work turned out is within the desired limits, the operators are to merely make frequent inspection trips to all of the machines, gaging a few pieces at each.

A special set-up and repair man should be employed if the department is so large that the foreman has not

time to do the setting up himself. Except in extreme cases, the operators should not be required to do this work. When not making set-ups, the set-up man may well be required to instruct the operators under him, inspect the machines, make repairs, etc. He is to make all repairs possible, although help will frequently have to be given him when machines have to be overhauled.

When starting in to do time study work in an automatic department, the first thing to do is to clean up the department and provide means for it to be kept clean. Workmen cannot be expected to maintain their machines in good working order if the machine and all of its surroundings are covered with oil that has caked and has not been removed. If the floor and other surroundings are kept clean, the operators will generally take pride enough in their own machines to see that they are kept clean also. Unless the operators are watched carefully, they are liable to feel that the oil guards are a hindrance and consequently leave them off. This is one of the principal reasons why some departments become so thoroughly besmeared with cutting oil and compound. These guards must be kept in position when the machines are running, and where there is one missing a new one should be provided.

It is next necessary to see that all machines are in first-class working condition. Although the foreman may think that all of the machines in his department are in good condition, if an attempt is made on any machine to operate at the maximum speed consistent with good work, it will usually be found that there are some attachments missing, the compound pump does not work just as it should, or any one of many other minor evils will appear that must be attended to. To see that all machines are in good condition, it is well to start a time study, each man taking studies on a group of about ten machines. He should record all time lost for any reason whatever. This will quickly call his attention to those faults which should be rectified.

While the machines are being put into condition, the time study man should make out a tool data sheet, Fig. 116, for the work that is on the machines. A great deal may be learned from a study of the data on these sheets. Having the information on the jobs as they are being run, it is now necessary to build up a new tool data sheet for each of the jobs, filling in the speeds and feeds desired in place of those in actual use.

Where the same job is running on two or more machines, it will frequently be found that widely different feeds and speeds are in use for the same tools on the same cuts. On one job I recall, a small pinion was being made on three machines, two Clevelands and a large Acme. One of the Clevelands was using a very high feed and speed on the form tool operation which controlled the remainder. The other Cleveland, of the same size and general condition was running at a low speed and a medium feed, while the Acme was a fair average between the two.

In building up the theoretical tool data sheets, it is well in starting to use tables of feeds and speeds as furnished by most of the high speed steel makers. Later, this data can be supplemented by the results obtained in practice. In many cases, however, on special alloy steels, it will be necessary to determine what speeds are to be used without this help. The tool data sheets for the jobs, as running, will serve as a basis. It is well to use the highest feed and speed that is thought to be practicable. When the tool data sheets are made up, the jobs on the machines should be brought to the desired condition and started working on that basis. At this point, considerable patience must be exercised by the time study man and all connected with the work, as generally when he has set up the

SKETCH OF PIECE WITH TOOLS IN POSITION	PART NAME	PART NO.
	TYPE AND SIZE OF MACHINE	MACHINE NO.
	MATERIAL	HARDNESS
	CUTTING COMPOUND	DATE
SHOW DIMENSIONS	REMARKS ON SPECIAL CONDITIONS	
	OPERATOR	OBSERVER

OPERATION NO	OPERATION NAME	OPER TIME	MAX DIAM OF CUT	R.P.M.	LENGTH OF CUT	DEPTH OF CUT	METAL REMOVED PER MIN	FEED PER REV	CUTTING SPEED		TOOL NUMBER	TOOL NAME	TOOL STEEL	LIFE OF TOOL

FIG. 116. TOOL DATA SHEET

DATE	OBSERVER	PART NAME	PART NO.
MACHINES PER OPERATOR	OPERATOR	MACHINE SIZE AND TYPE	MACHINE NO.

PERSONAL	DESCRIPTION OF DELAY

FIG. 117. TIME STUDY SHEET

	ESTABLISHED STANDARD TIMES IN MINUTES																	
	BROWN AND SHARPE				CLEVELAND													
	00	0	2	2G	5/8	7/8	1	1 1/4	1 3/4	2	2 1/2	3	3 1/4	4	4 1/2			
Feed round stock	0.75	0.80	1.00	1.00														
Feed square bar	0.50	0.75	2.00	2.00														
Cut from tool	6.00	6.00	?	?														
Cut off tool	5.00	6.00	5.00	6.00														
Change die	3.00	3.00	3.00	3.00														
Change dead	3.00	3.00	3.00	3.00														
Change hollow mill	3.00	3.00	3.00	3.00														
Remove chips	2.00	2.50	3.00	3.00														
Oil machine	1.50	2.00	2.50	2.50														
Interference per hr	1.00	1.00	1.50	1.50														
Feed daily interference	10.00	10.00	15.00	15.00														
Screw-slotting attach	15.00	25.00	40.00	40.00														

FIG. 118. FORM FOR TABULATING STANDARDS

machines to run as desired, he will find that some of the tools do not stand up well enough to warrant the speed or feed used. Before conceding that the standard is too high, he must be very sure that the machines and tooling are in the proper condition. There are any number of reasons why tools do not stand up properly, and only too frequently the experimenter blames his trouble on the speed as the condition most easily remedied.

At this point also, one must remember that the feed per revolution has very little effect on the heating of the tool, this trouble being almost entirely dependent on the surface speed of the cut. The feed per revolution used is most generally dependent on two conditions, that is, on the capacity of the machine and on the finish desired. While this is well understood, I mention them so that they may not be forgotten even for a moment.

Before condemning the surface speed the machine and tools should be very carefully studied. The trouble may be due to loose or worn bearings, loose or worn toolholders, toolholders too lightly constructed, tools improperly set, tools improperly ground, tools improperly hardened, turrets too loose, cams too loose, lack of proper coolant and lubricant, slipping belt, and many other lesser evils.

One of the principal troubles as a rule, is the hardness of the tools used. Only too infrequently are sufficient precautions taken in hardening tools. Very careful attention may be paid to the production parts; they are inspected, tested for hardness, polished, etc., but in the same departments the tools are merely given to a man to be heated and quenched according to his best judgment, after which they are sent directly to the tool stock or to the tool grinding department without further inspection. Unless the tools are of the proper hardness, they will not hold their edges and will, as a result, burn up very quickly. The present tendency to use several kinds of high-speed steel aggravates the trouble experienced with tools, because it tends to give just so many more chances for the wrong hardening process, as most of the various steels require a slightly different quenching temperature or handling. The use of only one or two kinds of high-speed steel is consequently very strongly advised. Determine on one or two brands and then stick to them.

The cams used should be studied very carefully to make sure that the feeds obtained from them are uniform. Sudden jumps in the feed of a tool such as might be caused by a nick or flat on a cam are very hard on the tools and work as they are liable to break the tool, loosen the holder or start a "chatter" on the work. It will frequently be found desirable to lay out and prepare new cams for many parts unless the department under consideration is exceptional. There is a strong tendency to use any cam that gives approximately the desired conditions, rather than go to the trouble and expense of preparing new ones. This is frequently false economy if the job is expected to run for more than a week, because the new cam will frequently effect a very material saving in time.

Having speeded up the machines to the figures as set down on the theoretical tool data sheet, some of the tools may stand up well enough to warrant a still greater increase. This is advisable wherever possible, not only for the added production but for the determination of new standards to be used later. It is advisable to run tests on as many different jobs as possible to determine just what the maximum practicable feeds and speeds are for the various qualities of finish desired.

In order to determine the number of machines that are to be controlled by one operator, it is first necessary to segregate certain classes of work and machines into groups. That is, plain cut-off machines should be in one class, the machines to handle the simpler drill and ream jobs should be in another and then the more complicated jobs with special taper tools, dies, etc. This forms a classification for the operator also. Cut-off work, for instance, calls for very little skill, while the best operators must be on the jobs which require the taper tools, cross drilling attachments, etc. An operator should be given enough machines so that his time will be occupied approximately 75 to 80 per cent in the changing of tools, stocking machines, adjusting tools, inspecting work, oiling machines and the other routine operations which he must perform. As a basis for making studies, it is well to give an operator from four to seven machines, determining the time he will be occupied from an estimate.

Having the machines running properly and the proper number of machines assigned to each operator, the final studies are to be made for the setting of standard time for rodding or stocking the machines, changing various types of form tools, changing drills, changing cut-off tools, removing chips, gaging work, oiling machines and interference.

These standards will vary on different types and sizes of machines and also with the shapes and styles of tools. However it will be found as a rule that on a certain type of machine, all sizes of bar stock used on that machine require practically the same amount of time for stocking. Some tools will require the same time for changing on all machines. Time is allowed for removing chips largely for its psychological value, for although the time allowed is generally small its presence on the final rate analysis sheet has a good effect on the operator. By interference is meant the time that one machine is not producing, caused by the operator's inability to give it the necessary attention, being busy with another. It is generally very nearly a function of the number of bars of stock that have to be put into the machine.

The studies will be made on the time study sheet, Fig. 117. Studies extending over a period of about two weeks on any one type of machine should be sufficient for setting the standard if a variety of jobs are being worked on. Of course, if a single job is being run during the entire time the standards may not be applicable to other jobs which come later. While taking these times, however, the time study man should instruct the operator, reducing the delays as much as possible and removing the unnecessary ones. Due to the fact that after the study the operator will have to operate more machines at one time than he has previously, considerable training of the men is usually necessary before they are capable of handling the machines properly.

The rates are to be set on the assumption that the operator has sufficient tools, properly ground, supplied to him. Too often it is the practice to allow the operator to grind his own tools and most of them by hand. This is uneconomical. In the first place, in grinding tools by hand, it is practically impossible to have them ground with the proper rake. Frequently they are considerably out of true. Then too, if the operator is to grind the tool, he must leave his machines, which is also bad practice. The tool grinders should be located cen-

trally, and some one person be made responsible for the grinding; if necessary, the operator can take the dull tools to the tool grinder and leave them, returning for them later and using one of his extra tools in the meantime. In a large department it is well worth while to have a boy make regular trips to all of the machines picking up dull tools and delivering the reground ones.

Having taken sufficient studies for the setting of the standards, the times required for various types of delay are summarized by size and type of machine and from these summaries the standards are set. All times which have been noted on the studies as unusual or not allowable should first be eliminated before trying to determine the standard.

The standard chosen should as a general rule be less than the average of all the times and should be the time which occurs most frequently in case there is any one time or times that stand out. This is done on the basis that this time is what should ordinarily be required. However, this rule cannot be used at all times and all conditions must really be judged after due consideration of all factors.

It should be remembered in setting the standards that the delays on automatic machine work are as a rule a small percentage of the actual operating time, and as a result, a 50 per cent error in a standard might affect by only one or two per cent the possibility of making the task. Consequently it is always well to be generous when establishing the standards, and the operator should be given the benefit of the doubt.

Having established the standards they should be tabulated for later use in setting the rates, as in Fig. 118. This table is best constructed with all of the standard allowable delays listed down the side and the various sizes and types of machines across the top.

In order to set a rate, it is now only necessary to establish the time per piece, the number of pieces from bar of stock and the tool data sheet, as follows, using B & S No. 2-G standards:

Piece 2½ in. long, bar stock 12 ft. long; approximately 55 pieces per bar; time per piece 1.00 min.; life of form tool 200 pieces; life of cut-off tool 300 pieces; life of drill 300 pieces; life of spot drill 2,000 pieces; per 10 hour day.

Feed 10 bars per day	@	1.00 ea.	=	10.00
Interference 10 bars per day	@	1.50 ea.	=	15.00
Change form tools 3 times	@	7.00 ea.	=	21.00
Change cut-off 2 times	@	5.00 ea.	=	10.00
Change drill 2 times	@	3.00 ea.	=	6.00
Oil machine 2 times	@	2.50 ea.	=	5.00
Miscellaneous interference			=	40.00
Remove chips 2 times	@	3.00 ea.	=	6.00
Allowable delay				113.00 min.
Possible minutes per day				600.00
Delay				113.00
Productive time				487.00 min.

$$\frac{\text{Production time } 487.00}{\text{Time per piece } 1.00} = 487 \text{ pieces per day.}$$

or 48.7 task per hour.

$$\text{Time allowance per piece } \frac{60}{48.7} = 1.231 \text{ min.}$$

Wage incentives on automatic screw machines can best be based on the task and bonus plan, on which basis, if the task of 48.7 pieces per hour is made, a bonus of 20 to 25 per cent is given to the operator with all pieces over the task carrying a rate similar to straight piece work. The object of the task and bonus plan is to require a certain minimum production before any incentive is paid.

The rate having been set, a tool list of the tools required on the job and an instruction sheet showing the set-up with dimensions for placing all of the tools are prepared for future guidance.

Time study of automatic machines is thus seen to present but few difficulties compared to studies on other machine tools. It is largely a question of seeing that the machine and tools are in good condition and then to make proper allowances. It is the varying human factors in machine operation that cause most of the difficulties in time study work.

The Apprentice's Problem

By R. H. Kasper

A question which frequently troubles the machinist's apprentice in the small shop is whether it would be advisable to remain in his present position or to seek employment in a large shop. It is a problem which is encountered by almost every apprentice, and about which he receives so much advice both pro and con, that his problem appears unsolvable.

The average machinist's apprentice has not chosen the trade because of any previous signs of talent, or desire for the work, but because he needed a "job," and necessarily took the first thing which presented itself. Having accepted, he is satisfied for a time, until, perhaps, a dissatisfied worker (who, by the way, is usually dissatisfied because he is not making good) makes the remark that "this is a one-horse shop." Then numerous questions spring up in the mind of the apprentice. "Would I learn more in a large shop?" "Am I working in a shop which does not employ modern methods?" "Would I advance more rapidly in a large shop?"—these are a few of the questions which resolve themselves into the one large question, "Shall I stay or leave?"

The problem frequently assumes gigantic proportions —and not without reason. Starting out in his life's work, the apprentice is anxious to succeed, but is hampered by the fear of starting on the wrong track, the fear that years may be wasted in vain efforts, the fear that the same years spent in another shop may spell the difference between success and failure. Some of us have never experienced these fears, but most of us have—and they have been quite disconcerting at times.

The apprentice pictures himself, years later, after having spent the best years of his life in a small shop, as a "half-baked" mechanic, unable to hold a position in a modern shop for any length of time. He sees himself wandering from place to place until finally he strikes another "one-horse" shop, where he must spend the remainder of his days in unpleasant surroundings at low wages and with no opportunity for advancement. Of course, the condition is greatly exaggerated in the mind of the apprentice, but most of us have come in contact with men, who, in spite of years of experience at the work, never succeed in producing a creditable piece of work. Although this is usually the fault of the man himself, he is frequently held up as a horrible example of the folly of sticking to the small shop. It is true that one cannot learn everything in the machine business in a small shop, but it is equally true that one's life may be spent in a large shop and still leave much unlearned.

In order to arrive at a satisfactory decision, the apprentice must view the question from all angles, and carefully compare the advantages and disadvantages of

the one shop with the advantages and disadvantages of the other.

In the large shop, where scores, or perhaps hundreds, of men are doing the same work, the absence of one for a day amounts to but a drop in a bucket. Among a large number of workers there are a certain number of absentees daily, and the daily or weekly output is usually computed with the proper allowances for the absentees. But in the small shop each man assumes a greater responsibility. His absence for a day becomes immediately noticeable, as certain work to which he would have been assigned has been left undone. He is a noticeable part of the organization, and he feels the responsibility. Should the output fall below normal, he feels it his duty to put his shoulder to the wheel in an effort to make it up. Thus by working in a small shop, the apprentice develops the habit of loyalty to his employer, which is a virtue frequently lacking in the large-shop worker.

In the small shop there is usually a greater variety of work than in the large shop. Some men are content to do the same work day after day, but most of us desire variety. Lack of variety becomes like a bread and water diet. Variety is the interest sustaining factor in all classes of work. Continued repetition becomes deadening to the senses. there is no interest; the worker becomes a machine, doing his work, perhaps, but with his mind elsewhere. When a piece of work or an operation can be done perfectly, it is natural for the worker to desire something different in order to increase his skill or knowledge, unless the pay is high enough to suppress such a desire.

An interested worker is a satisfied worker, and perhaps nothing goes further in sustaining the interest of the apprentice than the variety of work usually encountered in the average small shop. The worker is not bored with the realization that each day is to be a twin brother to the previous day, but begins his day's work knowing that each day means more knowledge to be acquired or new experiences to be encountered.

In the large shop each man may perform only one operation out of the many required to complete the work. Perhaps his work may not be noticeable on the finished product. In the small shop one man may perform several operations on the finished product, or he may complete the entire work. Working from the raw material to the finished product, he feels a certain pride in having produced something by the skill of his hands or brains. He feels responsible for the appearance and efficiency of the finished product, and the joy of having created something frequently overcomes the discouragements to which the apprentice is subject.

It is true that many small shops accept work for which they lack the necessary facilities. This is frequently necessary, as the refusal of one contract may mean the loss of others which could be handled efficiently. Thus it is necessary to adopt makeshift methods of doing the work, which proves the greatest bone of contention for the apprentice. He realizes that he could do much better work with the proper facilities, though he is sometimes surprised at the good quality of the work produced by the methods pursued. He does not realize that by employing such methods he is storing up knowledge which may some day prove of immense value. He employs methods which would not be dreamed of by the machinist who had always worked in a shop having a complete equipment. Most of us have heard the saying, "Anyone can work with tools, but it takes a good mechanic to work without them." There is a great deal of logic in the statement.

The worker in the small shop is usually given a piece of work and is permitted to work out his own salvation. The foreman is usually a worker himself and cannot spare the time to elaborately explain the method of procedure. The apprentice is thus thrown on his own resources to a great extent, thereby developing the ability to plan and reason for himself. Should he by a miscalculation find himself against a stone wall, so to speak, he must plan to get over it. Having safely passed the danger zone, he realizes that the same procedure may mean disaster the next time, and he firmly resolves that there shall be no next time. He profits by his error.

In the shop where everything is highly systematized the man in charge has carefully studied the work with the object of deciding on the quickest and best method of procedure. The machines to be used and the sequence of operations are decided on before the worker receives any orders. Under such conditions it is sometimes impossible for the worker to make a mistake and the worker who never makes an error begins to think that there is no such thing. Then, perhaps, his position may change, and having made an error, he is lost—he has not learned how to avoid mistakes as far as possible, nor how to rectify them when they occur. "The best scholar is not he who never makes a mistake, but he who never makes the same mistake twice."

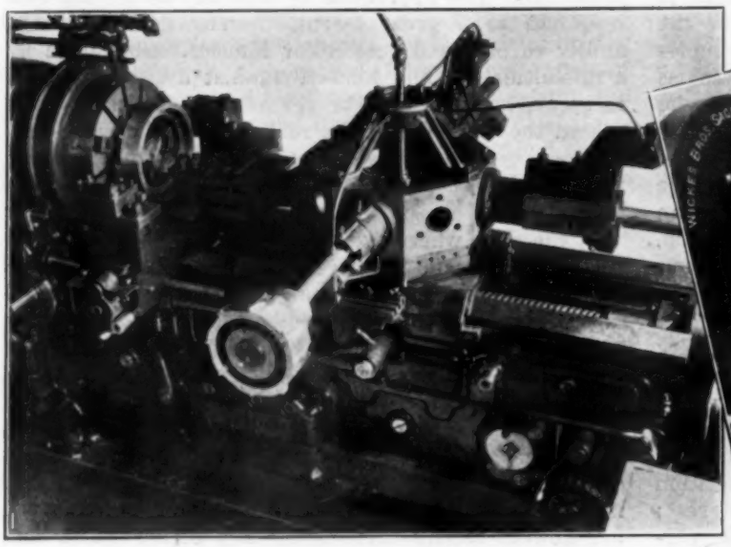
Another point frequently noticed is the difference of attitude between the workers themselves. In the small shop there is a sort of family spirit. Should one man find himself in a tight place the others are always ready with suggestions. In many of the larger shops, especially if there is a piece-work or bonus system, the prevailing attitude is "each man for himself and the devil take the hindmost." Nothing hurts the apprentice more than to find that his fellow workers have deserted him at a time when a few words of suggestion may mean so much.

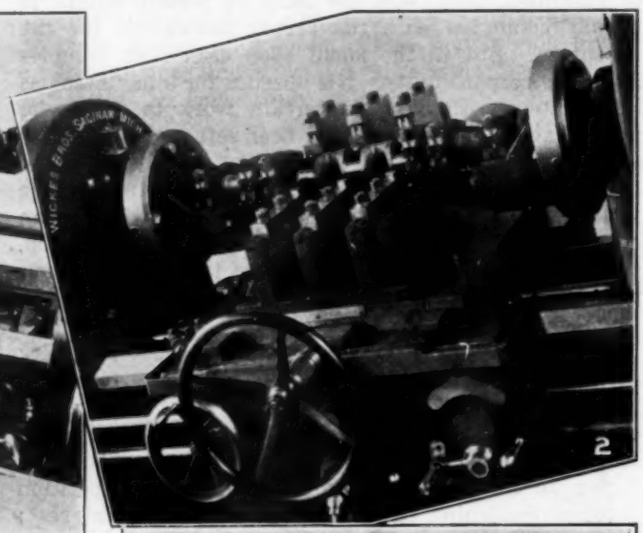
Of course, the worker in the small shop does not come in contact with the efficient methods pursued in the large shop, but such methods are described in detail in the technical magazines, while the methods of the small shop may not become known outside of the shop in which they originate.

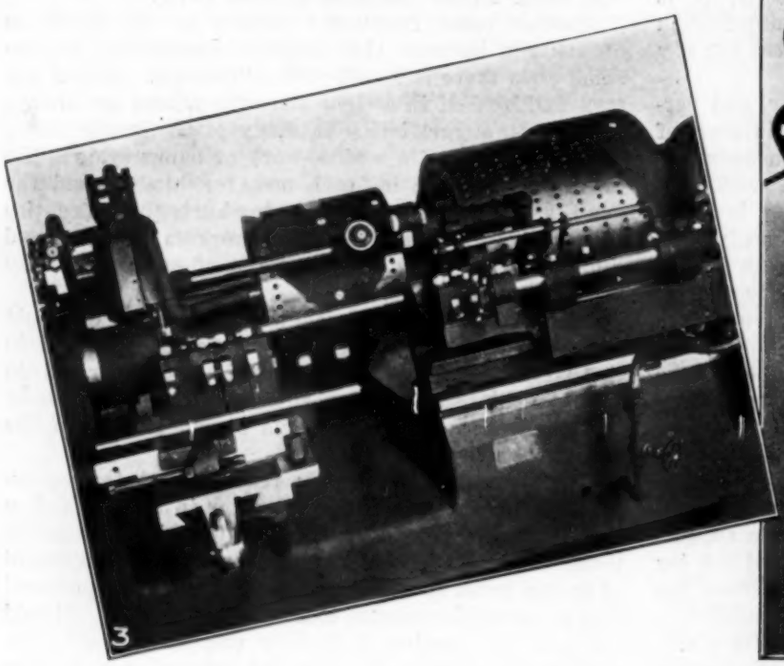
The apprentice frequently reasons that the opportunities for advancement are greater in the large shop than in the small shop. This is true in a sense, as there are positions in the large shop which are unheard of in the small shop. But it must also be remembered that each position is open to greater competition. Should there be an opening in a shop employing four men, each man's chance of being the selected one is four to one. But in the shop of one hundred men this ratio becomes one hunded to one. If mechanical ability is to be used as a basis for promotion, the man of exceptional ability is more easily selected from among the four than from among the hundred. Then, again, among the hundred there may be several of the same mechanical ability, and in such cases friendliness with a superior is often the cause of the selection.

The happy medium seems to be to acquire experience in both the large and small shop. Which should come first may be a matter of personal opinion, but it is a noticeable fact that the small shop worker experiences less difficulty in the large shop than the large shop worker in the small shop.

PRODUCTION







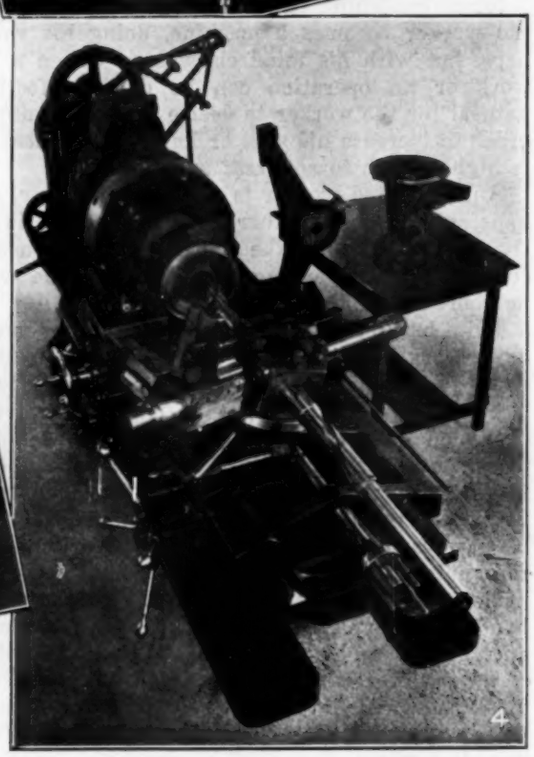


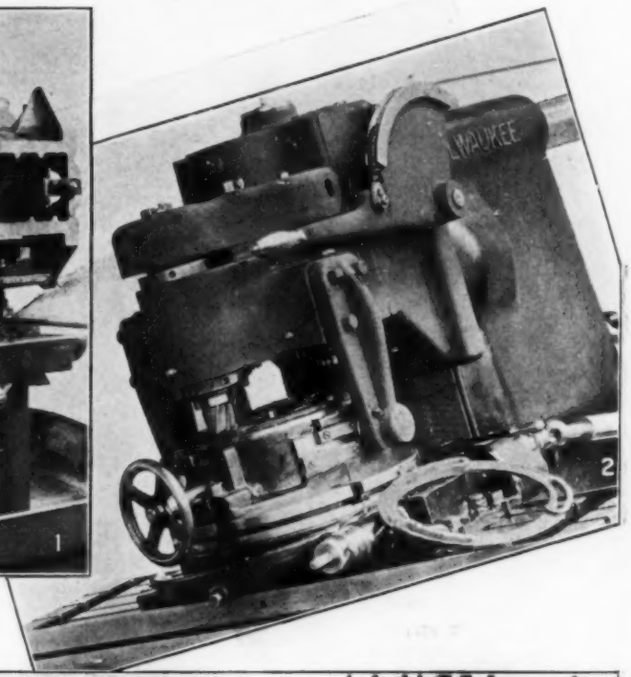
Fig. 1. The automatic turret lathe is a comparatively recent development. The 20-in. Gisholt automatic lathe shown herewith is machining ring-gear blanks of chrome-nickel steel. The work is finished all over, including an interior central web, and requires four operations and three chuckings. The blanks are 13 in. in diameter and 2¾-in. face and are completed in 28 minutes.

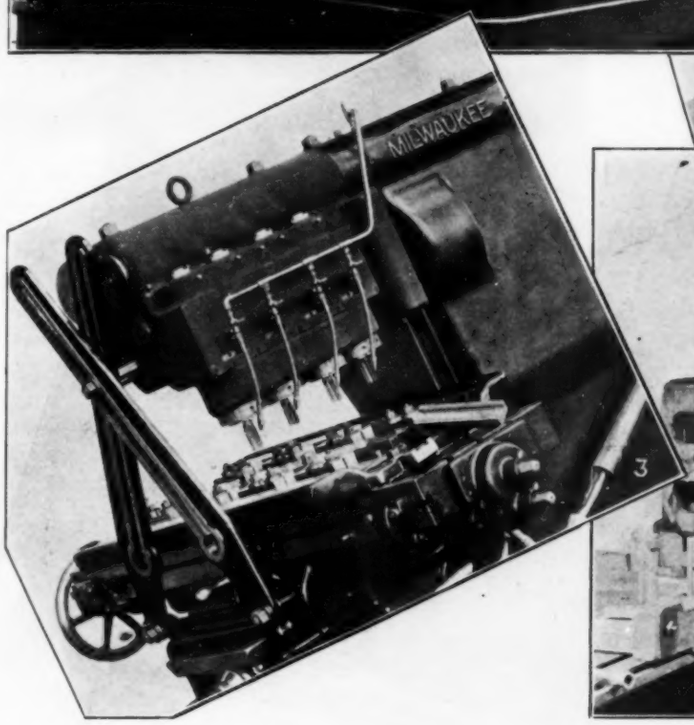
Fig. 2. The Wickes duplex crankshaft lathe shown in this illustration rough-turns two crankpins at one time. The time per pin is 3.07 min. Thus the pins on a six-throw crankshaft are roughed out in 18.42 min. As several machines were formerly required and the time taken was 81.6 per min. per shaft, the saving is 77.4 per cent.

Fig. 3. An automatic machine for turning shouldered-shafts has been devised by the Cleveland Automatic Machine Co. and is here shown together with a 1 x 17-in. shaft having nine shoulders which it turns out at the rate of four shafts per hour. The performance of this machine would make the old time lathe hand "Sit up and take notice."

Fig. 4. Here is a 24-in. Gisholt turret lathe machining an axle housing for a tractor. The tool set-up can be clearly seen in this rather unusual view. While two operations and two chuckings are required, the work is completed in 14 minutes.

IN PICTURES





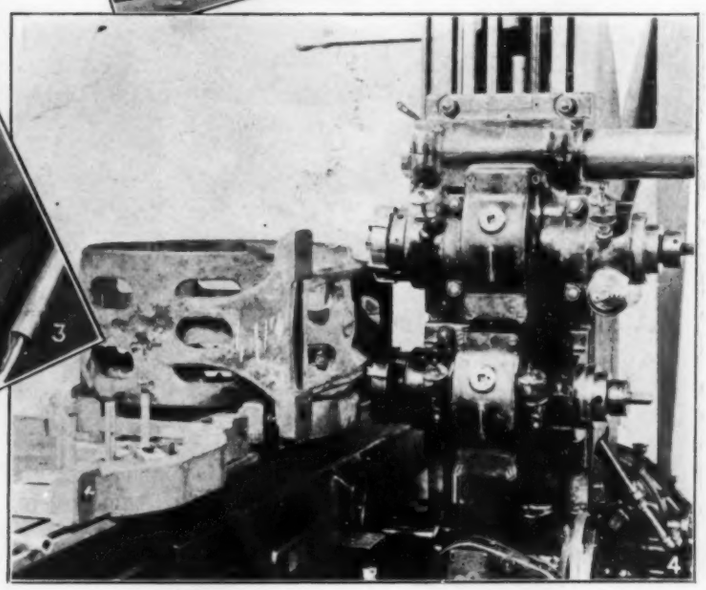


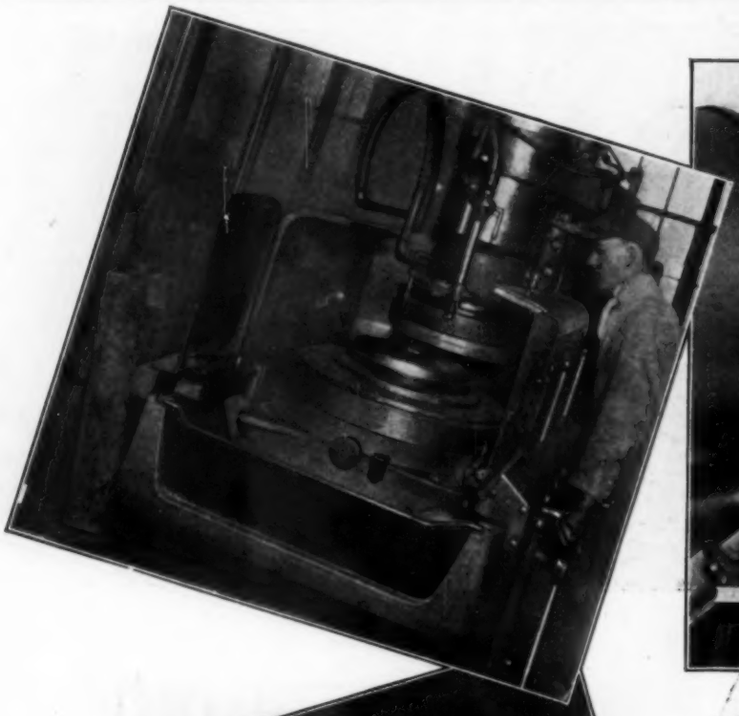
Fig. 1. In this view is shown a 48-in. Cincinnati duplex automatic milling the end pads on crankcases. The head at the left is especially arranged for the work and carries two spindles. The two station fixture permits loading and unloading without interrupting the work. With a feed of 3½ in. per minute the production is forty pieces per hour.

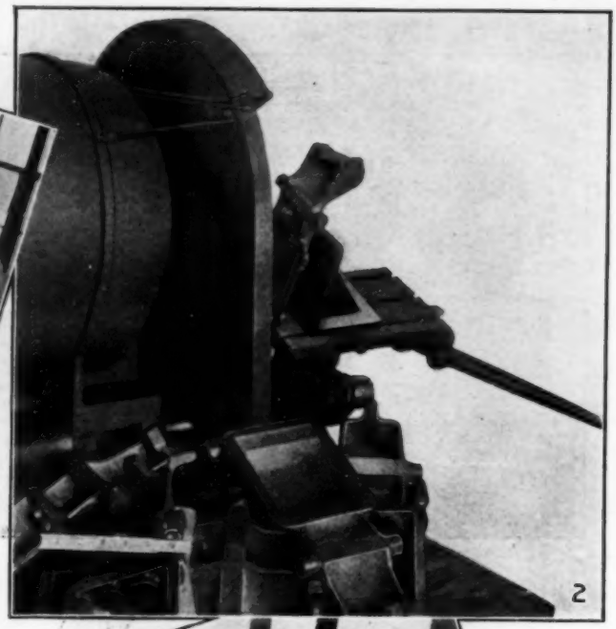
Fig. 2. Here is a Milwaukee milling machine with a special head carrying three vertical spindles. Three pads on a circular piece are being milled in steps. As the fixture revolves it is raised from step to step by cams and the work is completed in 1 min. 16 sec. The number of operations and set-ups that would be required on a single-spindle machine is apparent.

Fig. 3. This illustration shows a No. 3B plain Milwaukee milling machine, milling channels in steel toolholders. The special head carries four spindles and the work is ganged in the fixture shown. It does not require a mathematician to tell how much this arrangement beats doing the work with a single cutter.

Fig. 4. A No. 33 Kempsmith two-spindle production milling machine is shown in this illustration milling the bottom faces of field rings. Two fixtures are used permitting loading and unloading without stopping operations. An automatic quick-traverse prevents cutting wind between surfaces and the production is 9.6 pieces per hour.

PRODUCTION





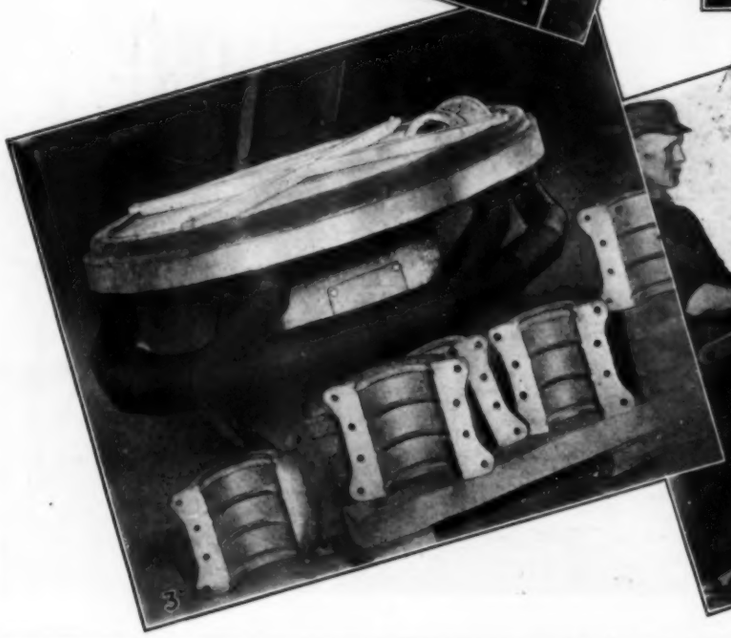


Fig. 1. Here is a No. 16 Blanchard vertical spindle rotary grinding machine at work on hardened-steel transmission gears. The work is ground on one side only. From 0.015 to 0.020 in. of stock is removed and the limits are ±0.005 in. Production, twenty-five pieces per hour.

Fig. 2. The Gardner No. 6 disk grinding machine shown in this illustration is grinding automobile transmission covers. The work rests on the table and is supported against the abrasive disk by a single point in the angle plate. As this point is in the center of the area to be ground it allows the work to float. Production is at the rate of 150 pieces per hour.

Fig. 3. Finishing large pieces on a vertical spindle disk grinding machine is an economical proposition. A Gardner No. 24 machine of this type is here shown grinding split pipe-sleeves of cast iron. The work with an added weight of about 100 lb. furnishes the grinding pressure. The area ground is 72 sq.in. and the amount of stock removed is 1/16 in. Production is fifteen to twenty pieces per hour.

Fig. 4. This Besly wet ring-wheel grinding machine was shown on page 707, Vol. 55, but errors were made in the production figures. Production on the large wrenches weighing 9 lb. each, should have been 100 per hour instead of 200; and on the small double-end wrenches 800 per hour instead of 600.

IN PICTURES

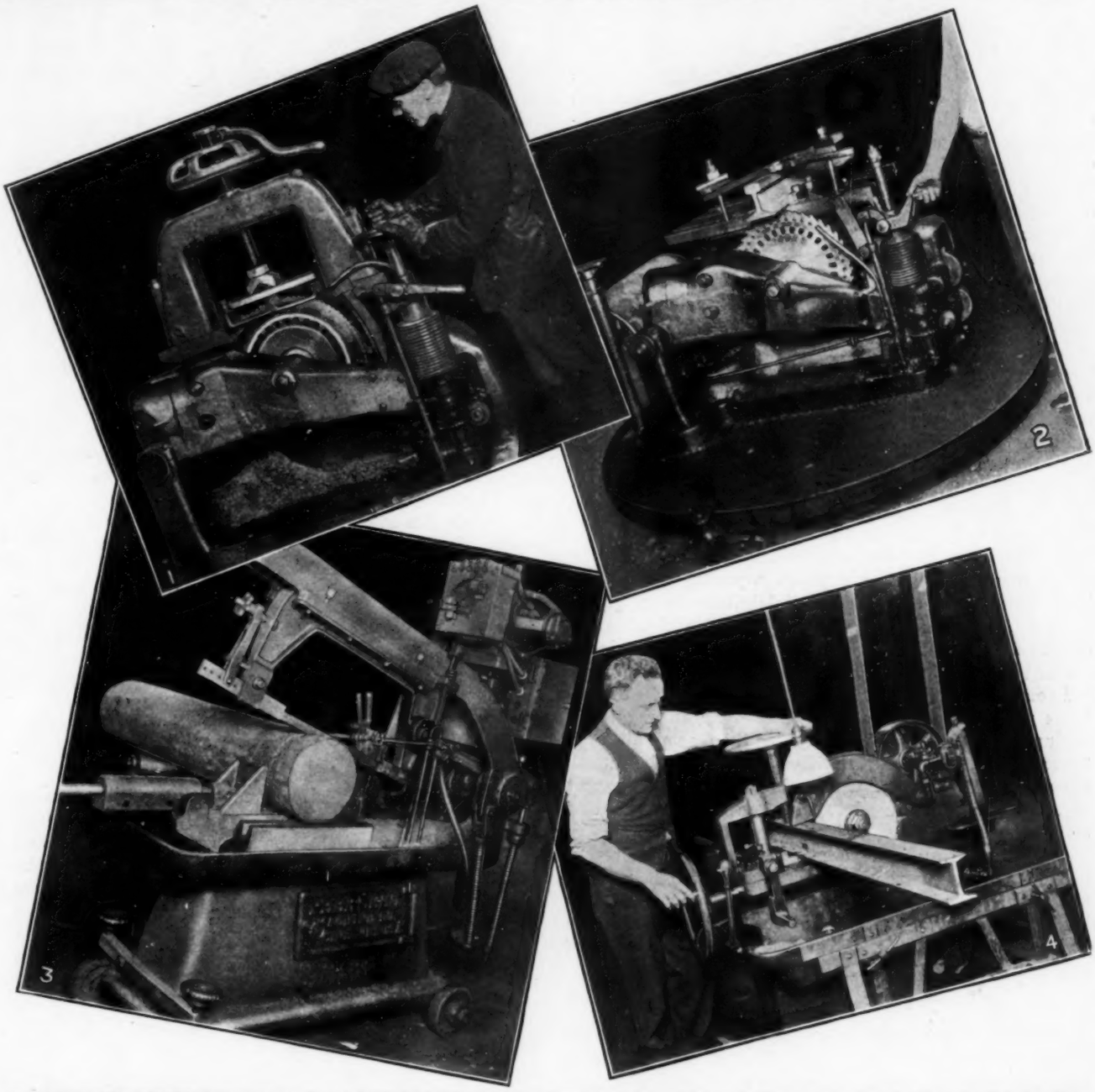


Fig. 1. When cold saws are fitted with proper clamping arrangement, more than one piece of work can be operated on at once. Here is a Lea-Simplex cold saw trimming the ends of two 7-in. channels. As may be seen from the location of the saw in the cut, this arrangement is a time saver. The saw has cut well into the second channel before passing entirely through the first one.

Fig. 2. The cold saw has of late years been recognized as a machine tool. The Lea-Simplex saw illustrated herewith is mounted on a turntable and can be revolved so as to receive bars from any direction. This feature is especially valuable when very long bars are to be handled or the space about the machine is small.

Fig. 3. One advantage of the hack-sawing machine is that the saws are comparatively cheap. The Peerless hack-sawing machine illustrated herewith is cutting a piece from a 9-in. bar of steel. Before the advent of such machines as are shown on this page, round bars were cut off in a cutting-off machine or a lathe, while bars of irregular shape were nicked by a cold chisel and then broken.

Fig. 4. The Nutter-Barnes cold saw shown in the accompanying illustration is cutting pieces from a 4-in. I-Beam. The cutting time is 5 min. but as one operator can attend to several machines, the cutting-off cost may be reduced to a minimum.

Diverting Burden Factors to Direct Production

Finding and Watching Non-Productive Costs—Direct Labor Usually the Smallest Item—Predetermination of Costs a Necessity

By P. B. HUSTON
Chief Factory Accountant, Cleveland Automatic Machine Co.

GREAT stress has been laid in the past on the productive labor cost in manufacturing product. Systems have been developed costing thousands of dollars, to determine how and where the productive labor cost is being used. And managers in most cases have lost track of the fact that productive labor, if properly handled, is not the largest part of the cost of the product.

To the productive labor cost is added burden, administration and selling expenses. In the past five years these added expenses in most cases have been the "dumping grounds" for much inefficiency and extravagance.

J. P. Brophy, vice-president and manager of the Cleveland Automatic Machine Co., by whom the writer has been employed, has always been insistent on cost reports of his product, but never required extreme accuracy to the exact penny on each class of product. His orders are not to "split hairs" in arriving at the cost of any unit. This has saved thousands of dollars by not having an excessive number of non-producers to figure details that would have proved of little value.

Very little money has been lost through not figuring these small details and a great amount might have been spent to find out what small details were costing.

At a convention of the Machine Tool Builders' Association in Cleveland last spring, a manager of a large eastern concern in an address on cost accounting, made the remark that he thought if the majority of corporations would set aside a fund each year to endow an asylum for "cost specialists" and then send all such "specialists" to this asylum, that they would be money ahead. This however, was rather a broad statement and one that would need to be taken with a "grain of salt."

Cost accounting is a necessity and has to be recognized as such, but the so-called "specialist" has sometimes run this phase of accounting to the extreme. He has frequently worked himself out of a job through his lack of knowledge of conditions and the value of the results of his statistics.

Predetermining Costs

In any well-regulated manufacturing plant it is necessary to predetermine costs. This is easily done if common sense is used. After these costs are set, all that is necessary is to have the production department see that the materials and productive labor operations do not cost any more than this predetermined figure. The manager can then control the other medium of costs, such as factory burden, selling and administration expense, by seeing that he receives reports at certain periods detailing these costs. A very small amount of clerical help can compile these periodical statements. The manager then has a chance to control the necessary burdens that have to be added to costs.

The method used in this control is practically the same as any other factor of costs. In predetermining costs it is necessary to set a standard on all the elements entering into costs; therefore this burden standard should be determined at this time.

In the manufacture of machine tools, the relations of the cost factors to the total cost are approximately: 35 per cent materials; 20 per cent productive labor; 45 per cent manufacturing burden, selling and administration expense.

The deduction follows that the heaviest factor in the costs is the non-productive feature or burden. Judging from the past it would look as though more of this indirect or non-productive expense could have been used on direct production had more attention been given this factor of costs.

Determining Standard Burden

In determining the standard burden, conditions of all sorts in your plant must be taken into consideration. These include floor space and the maximum number of productive man- or machine-hours your plant capacity will allow in any period. Compare this data with the average number of productive man- or machine-hours you have been getting from your factory in the past.

Over the same period compile your actual expenses and figure a man- or machine-hour rate for these expenses from your finding. Most concerns will be greatly surprised to find this rate per hour, if on the productive man-hour basis, is from 50 to 125 per cent greater than their productive man-hour rate.

After arriving at the actual rate, set a rate that will be on the basis of extreme economy—a safe standard for this factor of costs. From this standard rate determine a monthly total by multiplying by the average number of productive man- or machine-hours. The total arrived at must then be distributed to the various classes of expense. This can be done by taking the actual relation of each class to the total actual expense and then distributing the standard total on the same basis as the actual.

After this standard is distributed, monthly comparative statements can easily be compiled showing the management exactly where he is gaining or losing on his standard expense. The relation of the productive man- or machine-hours to the expense must always be considered in this report.

Power, light and heat, maintenance of plant machinery, buildings, small tools, patterns, jigs, etc., supervision, factory accounting and other manufacturing expenses should be carefully analyzed and cut where possible.

Cost of Welfare Work

One main expense that has not been mentioned above, upon which vast sums have been expended by many concerns is so-called welfare. Buildings have been erected, gymnasiums, reading rooms, dining halls and assembly rooms have been equipped and special directors of this work hired at large salaries. The benefit to be derived from such a source has been greatly over-estimated and

instead of increasing efficiency and production has added to the cost of production.

Do you know in your plant whether it pays or not? A certain amount of it does, but in the writer's opinion 75 per cent of it could be done away with and this money be devoted to other channels more profitably.

The average employee's natural inclination on being relieved of his labors is to seek recreation away from his place of employment. He does not appreciate this vast expenditure. A conservative amount spent on this branch of industrial expense is necessary. A clean, light, well-ventilated place to work, sanitary toilets with lockers and shower baths, a clean place for employees to eat their lunch and a well-equipped first aid hospital are all essential.

Any more elaborate plans promoted by employees themselves should be entirely under their control and personal expense, with a possible small donation by the firm to encourage anything beneficial to the employees' health or education.

Laying Out a Factory for Production Work

By FRANK W. CURTIS
Chief Engineer, Dowd Engineering Co., New York City

(Continued from last week's issue)

CERTAIN classes of work can be handled in more than one way and the method used may affect the factory layout to a considerable extent. Fig. 5 shows a piece of work of this nature. This work is

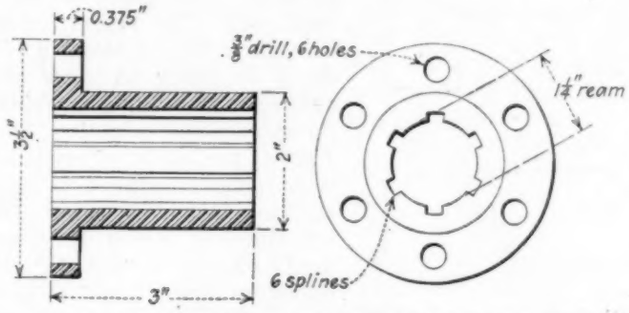


FIG. 5. EXAMPLE OF PART TO BE MANUFACTURED FROM A FORGING

a combination flange and hub and the operations were laid out in two different ways in order to determine which would be more profitable.

First Method:

Op. 1. Drill, bore and ream hole; rough and finish turn O. D.; face end and back of flange.

Op. 2. Broach spline cuts in hole.

Op. 3. Face flange end and turn O. D. of flange.

Op. 4. Drill six holes in flange.

Total time required for this method, 11 minutes.

Second Method:

Op. 1. Rough drill large hole and spot-face end of hub.

Op. 2. Broach round hole in hub.

Op. 3. Broach spline cuts in hub.

Op. 4. Face both sides of flange and turn O. D.

Op. 5. Rough and finish turn hub. (Two machines.)

Op. 6. Drill six holes in flange.

Total time for this operation, 9½ minutes.

It will be seen that the second method is somewhat faster than the first method and in addition to this the tools required and the machines used are less expensive. In the first method, the first operation is performed on a turret lathe and it requires some special tooling. Reaming of the hole requires an adjustable reamer in order to keep the work up to the proper size. Some of the other tools also are of a special nature. In the second method the first operation is a very simple one and the upkeep of tools is extremely easy, a jig only being used. The broaching of the round hole in the second operation is in accord with modern practice, and the upkeep of the broach is excellent. The fourth and fifth operations in the second method require only the use of an engine lathe with simple tooling.

It can therefore be considered that the second method is more profitable both from the viewpoint of higher production and also on account of the upkeep of tools.

A number of points of importance must be taken into consideration when making a factory layout. Some of these points are noted herewith:

(1) What machine tools are on hand that can be used in the production? Are these machines new or old, and if the latter, what condition are they in? Do they need overhauling before they can be used, or have they been recently inspected?

(2) What is the nature of the product and how great a production will be required?

(3) Is it the intention to manufacture the product complete in this factory or will some parts be manufactured outside? (4) Is there a likelihood that production will later be increased? If so, provision should be made for inspection and the setting up of additional machines, which should be done as far as possible without disturbing the routing of the work.

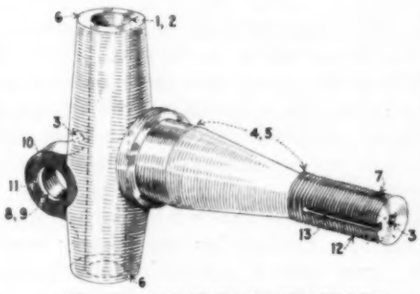


FIG. 6. EXAMPLE OF WORK SHOWING MANUFACTURING OPERATIONS REQUIRED

(5) Is money available for the purchase of new machine tools if required? If not, what provision can be made with the equipment available to handle some of the difficult work which would ordinarily require a different type of machine?

(6) What is the tool equipment available? Are the tools which have been designed efficient or must new designs be made? If new designs are to be made is it possible to obtain the services of a strictly first-class tool engineer who understands the value of high production tools.

(7) If the layout of operations has been made and time studies computed, is it capable of being improved; that is to say, have the feeds and speeds been set and

are they practical and productive of the greatest possible output?

(8) What provision is made for handling material? Suitable aisle space must be provided with plenty of room for trucks to pass each other. If conveyors are to be used are they to be power operated or by gravity? The nature of the work naturally determines some of these points, yet they should all be considered before making the factory layout in order that proper provision may be made for rapid handling of the product.

(9) How will the departments be divided? This is an important point because if one unit is to be handled in a department devoted to that unit exclusively, a different arrangement of machines will be required than if the factory is to be arranged with separate machines departments.

(10) Is the inspection to be handled by departments or separately? This is a matter for the factory management to decide upon and it naturally affects the factory layout to some extent as provision must be made for inspection according to the method used.

(11) Assembling department: This must be proportioned according to the production required and provision must be made so that there will be ample room to assemble and test the mechanisms before they are shipped.

(12) What shipping facilities are there? In considering this matter the nature of the product also is an important factor. If the units are small, they may be boxed in small boxes, while if they are large, they may require heavy crating.

All of the points mentioned have a bearing on the factory layout and they should therefore be considered with care in the early stages of the development.

We have previously given an example of a factory layout for general manufacturing. In this layout the departments were separated as they should be for a factory of this kind. In very high production work, however, it is often found more economical to devote an entire department to a single part and arrange the machine tools in such a way that all of the work on one part will be done in this department. The steering knuckle shown in Fig. 6 is an excellent example of a high production part which is manufactured in a department set aside for this purpose alone. In referring to this piece it will be seen that it is a forging on which there are a number of operations. In order to make the matter clear an operation sheet is given showing the method of handling as well as the time of production and the machine tools used on each part. Reference numbers for the various operations will be found on the part drawing, so that the various machining operations can be readily followed.

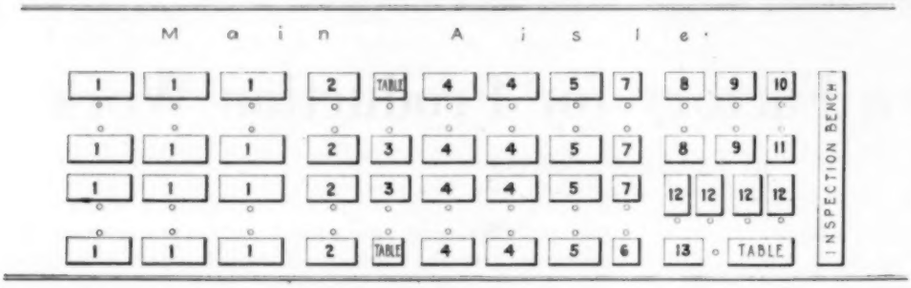


FIG. 7

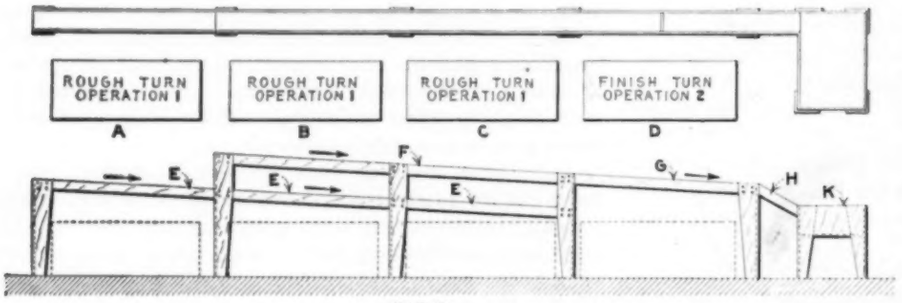


FIG. 8

FIG. 7. LAYOUT OF MACHINES FOR PART SHOWN IN FIG. 6, FOR PRODUCTION OF 4,000 PIECES PER EIGHT HOURS. FIG. 8. ARRANGEMENT OF CHUTES FOR HANDLING WORK BETWEEN OPERATIONS

The production required on this part is 4,000 per day of eight hours and the machine arrangements are such as to make sure that this number of parts will be obtained under all conditions. The production of this piece will be taken up in detail in order to show the method of arranging machines for economical production. Fig. 7 shows the layout of machines with numbers applied to each machine to correspond to the operation on which they are used. By referring to the operation layout it will be easy to understand just what are the functions and purposes of the various machines. A brief mention will be made on each operation to show how the required production is obtained.

The first operation of drilling a $\frac{5}{8}$-in. hole is done on a four-spindle gang drill, the production obtained being 363 pieces per eight hours for one machine. Twelve machines are required to give the necessary production and allow for the possibility of break-downs in production.

OPERATION SHEET FOR PART SHOWN IN FIG. 6

Oper.	Operation	Machine	Production —8 Hrs.
1	Drill $\frac{5}{8}$-in. hole	4-spindle drill press	363
2	Ream 0.685-in. hole	Special	1,480
3	Center both ends	Centering machine	2,350
4	Rough turn	Lathe	520
5	Finish turn	Lathe	1,296
6	Face to length	Drill press	4,320
7	Drill 5/32-in. hole	Drill press	1,700
8	Drill 47/64-in. hole	4-spindle drill press	2,100
9	Ream 0.749-in. hole	Drill press	4,320
10	Spotface	Drill press	4,320
11	Countersink	Drill press	6,480
12	Chase $\frac{3}{4}$-in. thread	Threading machine	1,296
13	Mill keyway	Hand miller	4,320

The second operation, which consists of reaming the 0.685-in. hole, is done on a special machine giving a production of 1,480 per eight hours. Four machines are required to take care of this operation.

The third operation of centering the ends is done on a center drill on which a production of 2,350 per eight hours is obtained. Two machines are necessary for this operation.

The fourth and fifth operations consist respectively of rough- and finish-turning. The portions specified by number are done on an engine lathe with special tool-

blocks. The fourth operation gives a production of 520 per eight-hour day which requires eight machines. The fifth operation gives a production of 1,295 per eight-hour day, requiring four machines.

The sixth operation consists of facing the work to length. This operation is done on a drill press producing 4,320 pieces per eight hours. One machine is sufficient to take care of the production on this piece.

The seventh operation is the drilling of the $\frac{5}{32}$-in. cotter-pin hole which is done on a sensitive drill giving a production of 1,700 per eight hours. This operation requires three machines to give the necessary production.

The eighth operation, which is the drilling of the $\frac{11}{32}$-in. hole, is done on a four-spindle drill press giving a production of 2,100 per eight-hour day. Two machines are sufficient to take care of this operation.

The ninth operation consists in reaming the 0.749-in. hole, the work being done on a drill press. This operation is very rapid and one machine would be considered sufficient under normal conditions. An extra machine is provided, however, in order to make sure that there will be no break-down in production.

The tenth operation, facing both ends of the hub, is done on a drill press, using a simple fixture. A production of 4,320 pieces is obtained in eight hours and one machine is considered sufficient for the work.

The eleventh operation consists of countersinking the hole in the lug on a drill press. This operation also is very rapid and 6,480 pieces are produced in eight hours. One machine is sufficient.

The twelfth operation is the cutting of the $\frac{3}{4}$ x 16-in. thread on a special machine using a die head. A production of 1,296 parts is obtained in eight hours. Four machines are required.

The thirteenth and last operation is the milling of the keyway on a hand milling machine; 4,320 pieces are obtained in eight hours and one machine is sufficient for the operation.

All of the operations mentioned are very rapid and the number of machines is so proportioned that there is little likelihood of break-downs which will tend to hold up the production. In addition to this, allowances are made in each operation for lost time and production is figured on a basis of 90 per cent of maximum.

In order to assist in the handling of work between operations, a system of chutes can be standardized so that it can be adapted to a number of conditions in the factory. When operators are handling work rapidly it is tiresome to stoop and pick up work and walk to the end of the machine to lay it down and then come back again and pick up a new piece and put it in position on the machine. By an arrangement of chutes such as that shown in Fig. 8, a great deal of this labor can be obviated. There are three lathes at *A*, *B* and *C*, all of which are being used to rough-turn a certain piece of work. Finish-turning is done by a lathe at *D*. The arrangement shown allows the workmen at *A*, *B* and *C* to take work out of the lower chute *E* as they require it, and when they have finished their operation the work is thrown into the upper chute *F* in the direction of the operator at *D*. A stop is placed at *G* so that the rough work does not pass beyond this point. When operator *D* completes his work he throws it over into the chute beyond the point *G*, from which position it travels down the slide *H* on to a table *K*. The chutes mentioned are made of sheet metal and they may be arranged in various ways according to the product that is to be handled. On certain classes of work it may be necessary to provide fiber guides on which the work can rest, so that it will not be marred in transit. The angle at which the chutes are set is naturally dependent upon the work that is to be handled. It will be found that devices of this sort are great labor savers and a little ingenuity in their construction will permit a considerable amount of standardization so that they can be applied in numerous cases throughout the factory. If work being handled is flat or irregular so that it will not slide easily, a roller conveyor can be used in place of the chute. Conveyors of this kind can be purchased or made up according to the requirements of the work. All of the devices mentioned facilitate handling and increase production in the factory. A conveyor system of this type was used in the layout shown in Fig. 7.

Big Shops vs. Little Shops

BY THE LATE W. D. FORBES

A most interesting report has been made by a British board of investigation into the relative costs of production in large manufacturing concerns and small makers of furniture. The board is known as "The Standing Committee on the Investigation of Prices, Costs, and Profits."

The report shows that the individual maker of furniture can compete with the large concern and make a satisfactory profit. This to my mind is a very encouraging report and one which will, to a large extent, affect the manufacturing world. The investigations show that the large manufacturer has to have a huge overhead, is allowed to work only eight hours, and is constantly encountering strikes and other labor interruptions, so that the selling cost runs very high.

On the other hand, the small and individual furniture maker can work ten hours, and there seem to be men willing to work that length of time. Often the shop is in the man's house or yard. Then, being able to sell direct to the buyers, he is able to collect more promptly, and turns over his money more quickly. The report goes on to say that the small furniture maker does as good work, and in many cases better work, than the large manufacturer, who seems to have only the advantage of lower cost of material, as by buying in large lots a better price is obtained in lumber and other materials.

The board is soon to report on other industries, and I feel sure that the same conditions will be found. There is no doubt in my mind, nor has there been for a long time, that the huge manufacturing concerns building certain machinery in this country have gone too far, and have passed the line which marks the economical point.

Time and time again the question has been discussed as to the disadvantage of shops being so large that the personality of the men is unknown to the employer. I have met men within the last three years who have asserted that their shops have increased in size but not in output; that it was far more difficult to keep up a high standard of work than when the shops were smaller, and, they added in several cases, that never again would they enlarge their works save for storeroom, and if more work was wanted they would build smaller shops in different localities. It has been said, and believed, that the small shop could not compete with the large one. In certain industries this is no doubt

true, but in building machine tools I am not at all inclined to admit it.

This is how, according to my exeperience, the large and small shops seem to back up the findings of the British board. I wanted a small job done only a short time ago and I wrote to four firms for a fixed price, or their rates per hour. This is what I sent to each firm.

The article required is as follows:

Material, tool steel; outside diameter of piece, 1¼ in.; thickness, ¼ in. A center hole is to be $\frac{1}{16}$ in. in diameter; at 1¼-in. pitch circle, ten $\frac{1}{16}$-in. holes are to be drilled evenly spaced; neither the outside diameter nor thickness is of moment, as either may vary $\frac{1}{32}$ in. above or below sizes given. The central hole must be concentric with the pitch circle and small holes, but the size of the central hole may vary several thousandths above or below.

The piece is not to be hardened.

One firm, a very large concern, wrote at once to say that it no longer did small job work. Another quite large one did not answer at all. A third gave me the price of $40, and stated that it would not be responsible for the hardening of the piece, and, as far as I could make out, would not be responsible for the work at all. The fourth concern, a very small one as compared with the others, gave a price of just one-eighth of the third concern. The work was done by the last party and was perfectly satisfactory.

The concern which gave the $40 price made me feel uncomfortable, as it showed me that one of the following conditions must have governed the bid: First, the work was not wanted. If this was so, was it not poor business not to so state? Second, the concern did not know what the piece would cost them, so put the price very high. As the party has been in business for years, this does not seem possible. Or lastly, the spirit of absurd profits had taken possession of the bidder; and it was thought proper to ask an exorbitant price, as he believed that he could get it, and did not even consider asking a fair price.

Now, it is possible that the $40 concern was very slack in work, and, as it was a large concern, the overhead was so great that even the $40 price would not cover the cost. The small concern that did the job could find work enough to keep it going full time, so that the overhead was kept down at all times. I know that during the war, and since, it has had about all it could do, but it has been wise enough not to take more orders than it could handle, and it has not increased its capacity greatly.

The small jobs are not looked upon with favor by jobbing shops, I know, and many small shops undertake them and believe that they make a profit while, as a matter of fact, they do not. But, on the piece such as I have described, the work is so simple that any experienced man could easily tell how long it would take to get the piece out.

Here is how I figure the job, doing the work in any well-equipped shop, and in the way, I think, that most machinists would turn it out. Take off the faceplate of a small lathe, say 12-in. swing, and put on a chuck. Get a piece of 1⅝-in. tool steel about 3 or 4 in. long from the storeroom, and chuck it up. With a side tool face off the end. Replace the side tool with a diamond or a half-diamond point, and bring the stock down to 1¼ in. in diameter, calipers being used for this size. Remove the diamond point and set a properly ground parting or cut-off tool and part the piece, getting the thickness with a scale. If this last-used tool is properly ground, it will make a good smooth cut. The chuck can be quite fairly left on the lathe and what remains of the steel must, of course, be returned to the storeroom. All this work may be charged to the lathe, and the time taken should not be more than one hour, at most.

The high-speed attachment will have to be put on a small milling machine, and the cross-platen and the dividing head mounted on it, also. A $\frac{1}{16}$-in. drill will have to be obtained from the toolroom for the ten holes, and also a drill for the center hole. But these drills are more than likely to be found in the toolchest of the milling-machine hand.

The index must be set for spacing the ten holes. If I were doing the job, I would get a piece of steel or brass tubing, say, with a $\frac{1}{16}$-in. wall and a 1⅝-in. diameter, and cut a piece from it just long enough to act as a stop for the tool steel disk when held in the dividing head chuck, thus backing up the piece while drilling. Others would use, perhaps, three small parallels. Then the dividing head would have to be brought central and the center hole drilled, the drill removed, the small drill put in place, the dividing head offset ¼ in. to meet the ¼-in. pitch circle, and the small holes spaced and drilled. This drilling must not be hurried, but done with care. When the drilling is done, the dividing head and cross-platen will have to be taken off and put away, as well as the high-speed attachment.

This would complete the actual work on the piece, and all the milling work should not take more than two hours, at the very most. Thus, all the time that can be charged against the job is three hours. The cost of the steel would not be 20 cents. To ask $40 for three hours' work looks like rank absurdity. It would be interesting to hear the opinions of some machinists as to what better procedure could be used in regard to getting out the work, or in reducing the time.

The small shop seems to show up in this country at an advantage, as it does in the English furniture makers' report; and it is an open question if small jobs can be made to pay in a large shop, even at wild prices. The further reports of the committee in England should make interesting reading.

An Apprentice with Resource As Well As an Automobile

Way back in March 1907 the *American Machinist* published a very humorous poem by Frank A. Stanley on the "Millionnaire Apprentice." Automobiles were far less common than at present but one stanza is particularly appropriate in view of a recent occurrence in a large machine plant. It ran:

"In his runabout trim to work he would skim
With Hawkins, his man, at his side;
They'd pass in a blur with a honk and a whirr—
Great Scott! how those fellows would ride!
Poor Hawkins held hard but got cruelly jarred
From the top of his head to his heels,
While Jim stayed aboard by the grace of the Lord
As he handled the levers and wheels."

The other day one of the apprentices of the large shop referred to above, in driving to work in his Cadillac had a puncture near the shop. Time was short, so he found a telephone, told his chauffeur to come fix the tire, while he landed in the shop just in time to punch the clock.

By all signs and tokens that boy ought to make good, in spite of the evident handicap of having all he needs anyhow.

Manufacturing Parts of Northway Trucks

Work on Pistons and Connecting Rods—Turning and Inspecting Camshafts—Crankshaft Balancing—Fixture for Assembling the Chassis—Pressing on the Rubber Tires

BY ROBERT MAWSON

IN this article are shown some of the methods and special tools, jigs and fixtures employed in making commercial trucks. The Northway Motors Corporation, Natick, Mass., manufactures two sizes of commercial trucks, 2 and 3½ tons capacity respectively and the tools used to machine the various units employed in the making of these vehicles show that much thought has been taken so that high-grade results can be obtained.

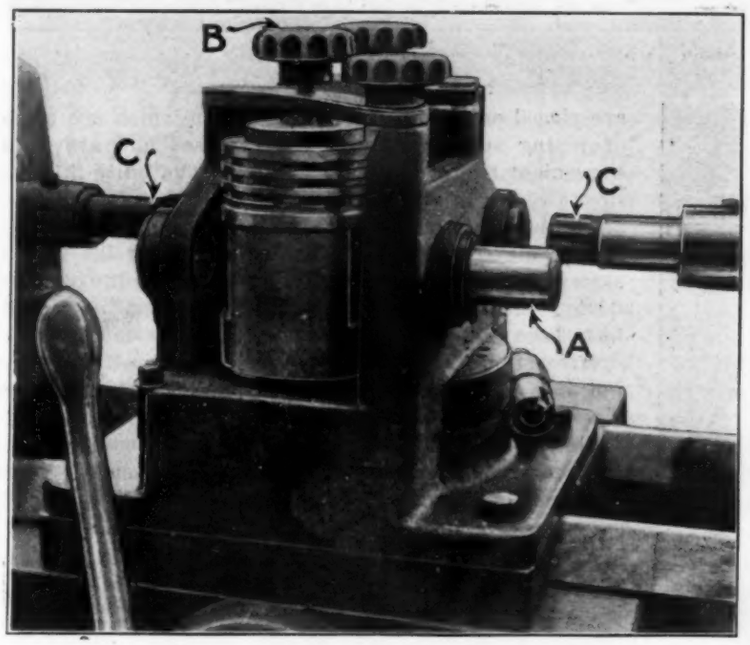


FIG. 1. REAMING WRISTPIN HOLES

The pistons are made of an aluminum alloy and are machined on the outside, the ring grooves cut and the ends faced, using standard automobile practice for these operations. The wristpin holes are then drilled in a jig, leaving material for the finish reaming, which is done in the fixture shown in Fig. 1. This fixture holds two pistons. The pin *A* is made with a tapered end, so that it will enter and locate the piston by means of the wristpin hole. The clamps on top of the pistons are tightened by the hand nuts *B*. The two reaming tools *C* are guided through long bushings so that the holes will be in line. During the reaming of one piston, another one is placed in position so that little time is wasted, the operation being almost continuous. The manipulation of the fixture is very simple, as the operator has only to loosen the hand nut when the clamp may be swung clear and the piston lifted out.

In machining the wristpin and crankshaft holes in the connecting rods, three operations are performed—drilling, rough reaming and finish reaming. The machine set up for these operations is shown in Fig. 2. The forgings are held in similar fixtures, each holding two pieces. At *A* the wristpin hole is being drilled and the large hole rough-bored. The second set-up *B* shows rough-boring or reaming of the small hole and second boring of the large hole. It will be noticed that at this stage both tools are guided both above and below the forgings, bushings being provided in the fixture for this purpose. At *C* the two holes are finish reamed. The jigs are then turned end for end and the operations performed on the other ends of the rods; it will be observed that the jigs hold the forgings with the large end of one next to the small end of the other.

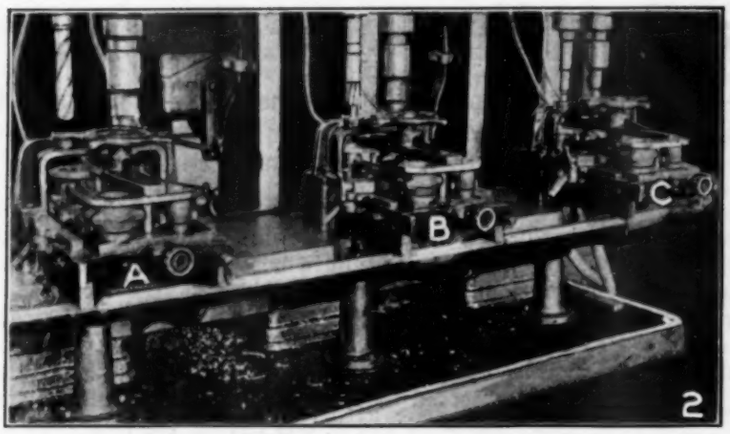
One of the jigs with the forgings removed is illustrated in Fig. 3. The connecting rods rest on the circular pads *A*. The large handwheel *B* is then operated and its action is to draw the wedges *C* toward the center and push out the V-blocks *D* which center and locate the rods. Rollers are provided at *E* so that the sliding member can be operated with the smallest amount of friction. The locating stop may be seen at *F*, the swinging strap at *G* and the notch into which it fits at *H*. It may be added that a number of sliding members are kept on hand so that as one set of rods is being machined other forgings can be placed in them, making the operation practically continuous.

After the caps have been parted and reassembled the rods are line reamed, using the fixture shown in Fig. 4. The plug *A* is placed in the wristpin hole and held in position by the screw *B*. The reamer *C* is guided in bushings on both sides of the forgings while the rod is held by a clamp operated by the screw *D*. It will be seen that the end *E* of this fixture can oscillate on a pin so that the rod can adjust itself for length between holes to suit the position of the reamers, a perfect hole for the crankshaft end of the rods rather than an absolute center distance between the holes being desired.

MACHINING THE CAMSHAFT

As the proper functioning of a motor depends in a large measure on the correctness of the camshaft great care is taken in its manufacture. A rear view of the lathe used when turning the camshaft is shown in Fig. 5. The shaft is carried on centers in the usual manner and supported by the two steadyrests *A*, while the arrangement of the tools, nineteen in number, may be plainly seen. The tools are spaced so that the sides of each cam lobe may be machined also the sides of the center bearings and the thrust collars at each end of the shaft.

A front view of the machine is illustrated in Fig. 6. The steadyrests are at *A* and it will be noticed that they are provided with rollers in order to reduce the friction to a minimum. The various turning tools are adjusted with the screws located in front of the toolposts. Lubricant is supplied through the four flexible pipes shown. The shaft is machined on the straight portions, the work being done in an ordinary lathe and the



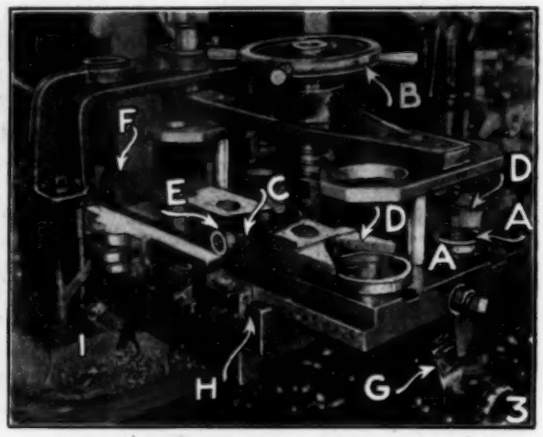


FIG. 2. DRILLING AND REAMING CONNECTING RODS. FIG. 3. ONE OF THE DRILLING AND REAMING FIXTURES

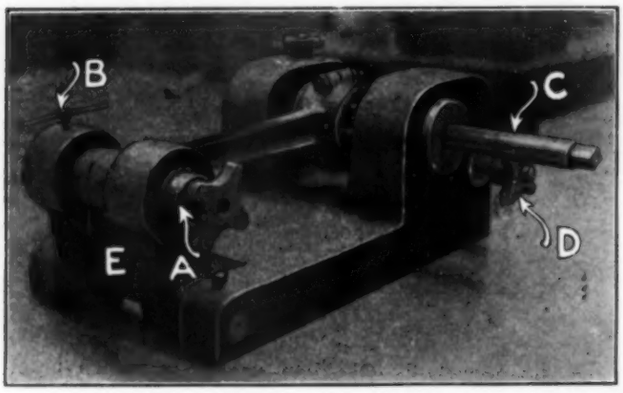
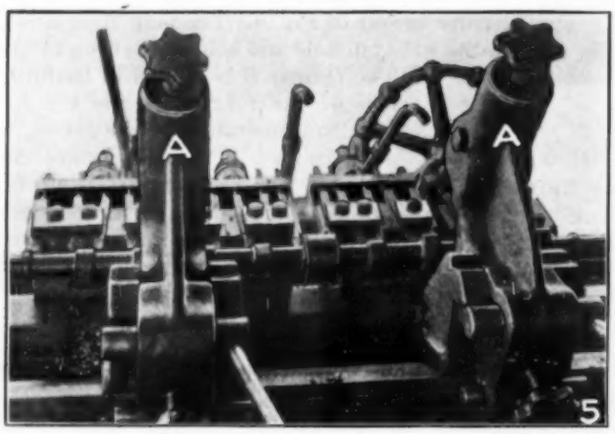


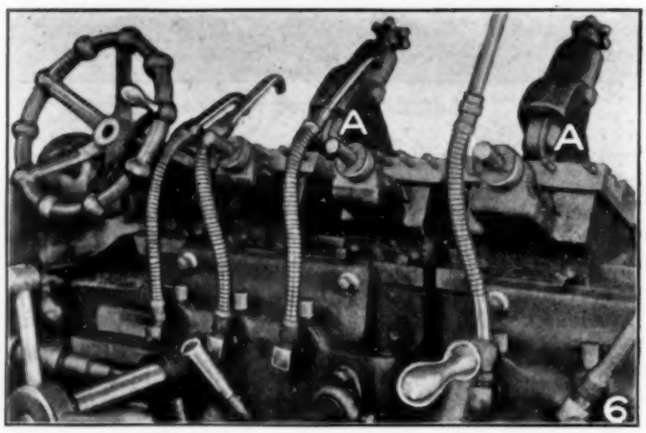
FIG. 4. LINE REAMING A CONNECTING ROD

are placed on the special stands shown which are made of piping suitably braced with trusses and are at a convenient height for placing the various units in position.

The stands are provided with castors so that they can be moved into any position desired on the trucks shown. As it is necessary to turn over the chassis during the assembling work, the revolving fixtures *A* have been provided one at each end of the frame.

After the crankshafts have been machined they are put into static and dynamic balance by testing in the Carwen machine shown in Fig. 9. The shaft is supported in the steadyrests *A* by the three main or line bearings, and revolved by means of the faceplate chuck *B* which is fastened to the outer bearing. The shaft





FIGS. 5 AND 6. TURNING THE CRANKSHAFT

various cams are next ground, using formers to control the grinding wheel.

Each camshaft is then given a rigid inspection in the machine shown in Fig. 7, the shaft being placed on centers so that it may be revolved by the inspector. The disk *A* is graduated in degrees so that by placing the dial indicator *B* over one of the cams and revolving the shaft the inspector can analyze each cam by the amount of its motion and its angular position. A chart is furnished the inspector showing the correct opening and closing locations for each cam also the proper lift or movement.

The chassis assembling department is at one end of the factory and is illustrated in Fig. 8. The frames

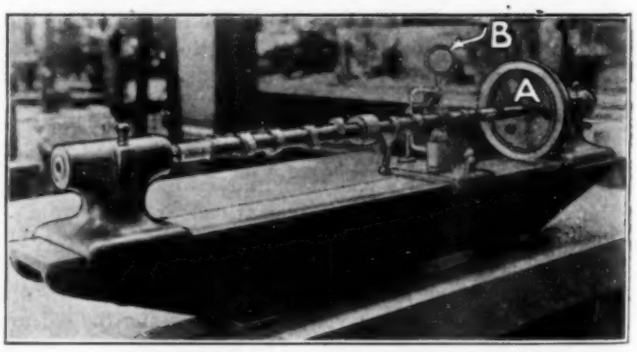
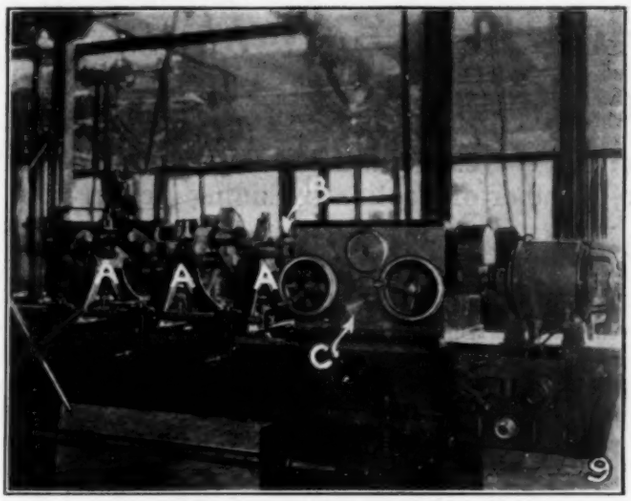


FIG. 7. INSPECTING A CAMSHAFT



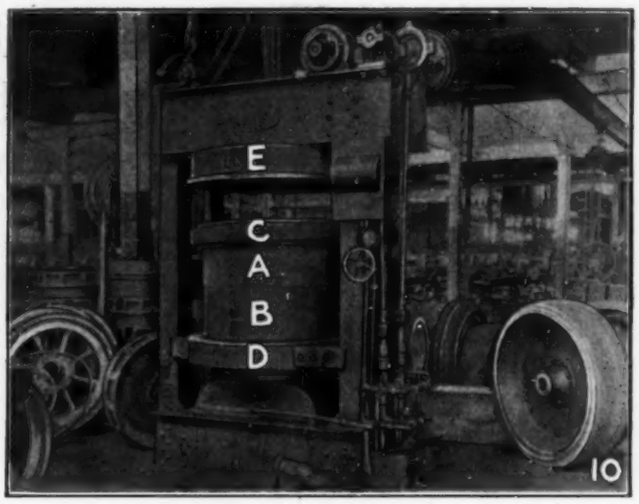


FIG. 9. BALANCING THE CRANKSHAFT. FIG. 10. PUTTING ON THE TIRES

is first put into static balance by drilling holes in the cheeks of the cranks when necessary until this condition is obtained.

The shaft is then put into dynamic or running balance by revolving it in the machine, the motor and rheostat for controlling the speed of the apparatus being shown at the right of the illustration. The amount of fluctuation or whip of the shaft during its revolutions is recorded on the indicator *C* and further drilling is resorted to when necessary until smooth running with absence of eccentric movement is obtained.

The hydraulic press used to force the tires onto the wheels is shown in Fig. 10. The steel wheel *A* rests on the base *B* and is located by means of a register on the inside. The solid rubber tire *C* is placed on top of the wheel as shown. The pump at the right is then operated raising the ram *D*, together with the wheel and tire until they come against the rigid flange *E*. As the

FIG. 8. ASSEMBLING THE CHASSIS

machine continues to force the parts upward, the tire is pressed onto the rim, the edge of the rim passing into the opening of the flange until the first tire is in position. The ram is then lowered and the second tire forced onto the rim in a similar manner, the wheels being of the dual tire type. The pressure required for the operation is approximately 150 tons. Some of the various types of wheels and tires used are shown in the illustration.

Figures on Production of Machinery During 1919 as Compiled by the Bureau of the Census

The Bureau of the Census is now compiling and publishing statistics of manufactures for the year 1919, which were collected during 1920. Tabulation of the statistics concerning production of machinery has been completed but it will be several months before the Census Bureau can issue its special bulletin for the industry.

An act of Congress which authorizes the taking of the 1920 census of manufactures provides for the collection of the manufacturers' statistics biennially hereafter covering the years 1921, 1923, etc. The canvass for the year 1921 will begin early in 1922. The success of the enterprise will depend entirely upon the rapidity and accuracy with which the manufacturers make their reports. Simplified forms have been prepared upon which statistics are to be reported.

The statistics of production of machine tools during 1919 specify a value of $222,504,654 for machine tools and certain accessories produced by 496 establishments. Of these plants 403 produce machine tools only.

The report shows the number of machines produced and their value by principal cities. Classes of machines are lathes (sub-divided into engine, turret, and bench and other lathes), milling machines (sub-divided into plain, universal, vertical, automatic, and other), gear cutting machines, grinding machines (sub-divided into plain, universal and other), drilling machines (sub-divided into radial, multiple spindle, sensitive and upright), screw machines (sub-divided into automatic and hand), boring machines (sub-divided into horizontal and vertical), planers, presses (sub-divided into punching and others), hammers, shapers, pipe machines, shears, broaching machines, bending machines, portable tools and all other machine tools.

Machinery other than machine tools is divided into the following classes and the value of machines produced by principal states is given: Adding and calculating, air compressors, bakers' blowers and fans, bottling, brick, pottery, cash registers, concrete mixers, condensers, confectioners, cranes, dairy, elevators, excavating, flour and grist mill, gas, glass making, laundry, leather working, metal working, meters, mining, oil well, oil mill, paper and pulp mill, printing, pumping, refrigerating, road making, rubber making, sand blasting, sewing, shoe, slot vending, steam shovels, stokers, sugar mill, typewriter, washing, wind mill, wire drawing, wood working.

The Bureau of the Census is under the direction of the Department of Commerce. W. M. Stewart is Director.

Design of Bevel, Helical and Worm Involute Gears

Application of Data of Author's Previous Articles — Determination of Helix and Tooth Angles—Relation Between Interference, Number of Teeth and Sliding Action

By A. B. COX

THE data and curves for interference, number of teeth in contact, and slip of teeth, worked out in preceding articles by the author in the *American Machinist* for involute spur gears, can be applied to involute bevel gears, helical and worm

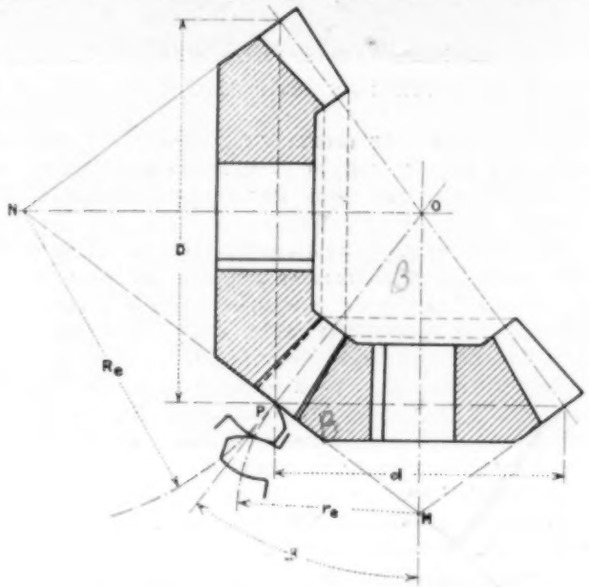


FIG. 1. ACTION OF BEVEL GEAR AND PINION

gears, and spiral bevel gears. The method of application for each of these types of gears is given herewith.

Bevel Gears

Referring to Fig. 1, a bevel gear of pitch diameter D having N teeth is shown meshing with a pinion of pitch diameter d and n teeth. The speed ratio of the gears is, of course, governed by the actual number of teeth. The ratio is $K = \frac{N}{n}$. In so far as the tooth action is concerned, the gears operate as though they were spur gears of radii r_e and R_e with shaft centers at M and N. r_e and R_e have been called the "effective" radii.

$$\tan \beta = \frac{d/2}{D/2} = \frac{d}{D} = \frac{n}{N}. \qquad \cot \beta = \frac{N}{n}.$$

$$r_e = \frac{d}{2} \sec \beta. \quad \text{Effective diameter } d_e = d \sec \beta.$$

$$R_e = \frac{D}{2} \csc \beta. \quad \text{Effective diameter } D_e = D \csc \beta.$$

The effective number of teeth $n_e = Pd_e$

$$= Pd \sec \beta = n \sec \beta. \qquad (1)$$

Similarly $N_e = PD_e = PD \csc \beta = N \csc \beta. \qquad (2)$

The effective ratio $K_e = \frac{N_e}{n_e} = \frac{N \csc \beta}{n \sec \beta} =$

$$\frac{N}{n} \cot \beta = \frac{N^2}{n^2} = K^2: \qquad (3)$$

By using n_e, N_e and K_e instead of n, N and K, the values read from the curves for straight-face spur gears will be correct for bevel gears of ratio K having n and N teeth. The actual number of pinion teeth n for actual gear ratio K has been transposed from the spur gear interference curve on Fig. 2 by this method and plotted as a separate curve on the same sheet for bevel gears. The minimum number of actual pinion teeth necessary with any ratio of bevel gears to prevent interference can be read direct from the curve.

Helical and Worm Gears with Shafts at Right-Angles

The effective number of teeth of helical and worm gears is found as follows: In the plan view of Fig. 3 are shown two mating helical gears of pitch diameters D and d whose teeth mesh together on their center lines in the direction a-b. If the face widths of the gears be extended to w' and W' and a section A-B be taken perpendicular to the teeth at the point of contact between the two gears, the sections will appear as two ellipses of major axes $d \csc \alpha$ and $D \sec \alpha$ and minor axes d and D, where α is the tooth helix angle of the gear having the larger number of teeth. The radii of curvature at the point of contact O of the two ellipses are found by calculus to be

$$r_e = \frac{d^2 \csc^2 \alpha}{4 \times d/2} = \frac{d \csc^2 \alpha}{2}$$

$$\text{and } R_e = \frac{D^2 \sec^2 \alpha}{4 \times D/2} = \frac{D \sec^2 \alpha}{2}.$$

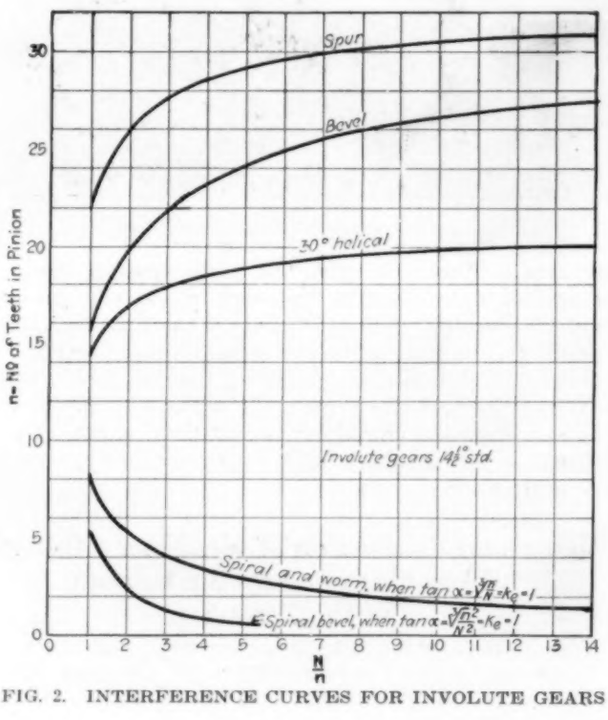


FIG. 2. INTERFERENCE CURVES FOR INVOLUTE GEARS

The effective diameters are, therefore,

$$2r_e = d_e = d\csc^2\alpha, \text{ and } D_e = D\sec^2\alpha,$$

and the effective numbers of teeth are

$$n_e = P_n d_e = P_n d \csc^2\alpha$$

and $N_e = P_n D_e = P_n D \sec^2\alpha$, where P_n = the normal diametral pitch.

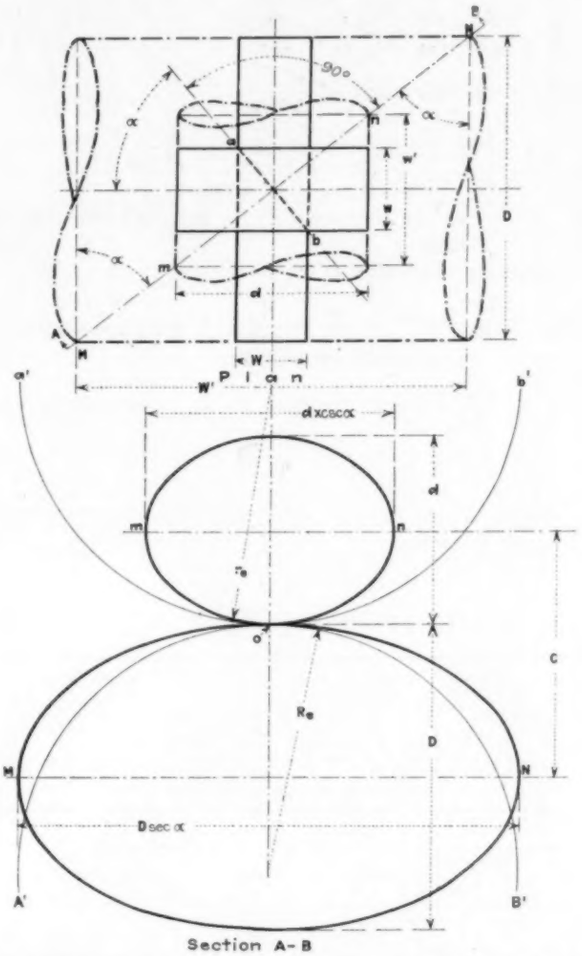


FIG. 3. DIAGRAM FOR CALCULATION OF FORMULAS FOR HELICAL GEARS WITH SHAFTS AT RIGHT-ANGLES

But $d = \dfrac{n}{P_n \sin\alpha}$ and $D = \dfrac{N}{P_n \cos\alpha}$ (from Machinery's Handbook).

Therefore, $n_e = n\csc^3\alpha$, (4)

and $N_e = N\sec^3\alpha$ (5)

and the effective ratio

$$K_e = \frac{N_e}{n_e} = \frac{N\sec^3\alpha}{n\csc^3\alpha} = \frac{N}{n}\tan^3\alpha = K\tan^3\alpha \quad (6)$$

Fig. 4 shows how any effective ratio can be obtained. It should be noted that the effective ratio can be made the exact reverse of the actual ratio. When $K_e = 1$, $n_e = N_e$, and $K\tan^3\alpha = 1$.

$$\tan\alpha = \sqrt[3]{1/K} = \sqrt[3]{n/N} \quad (7)$$

This gives the effect of two equi-diameter gears of equal numbers of teeth meshing together. Formula (7) can also be obtained by differentiating the formula for center distance,

$$C = \frac{n}{2P_n \sin\alpha} + \frac{N}{2P_n \cos\alpha}, \text{ equating } \frac{dC}{d\alpha} \text{ to zero and reducing, for minimum center distance.}$$

In Fig. 5 an actual case has been plotted, using a center distance C against helix angle α. A center distance of 11½ in. and helix angle of 33 deg. 16 min. was used in cutting these gears, though it is apparent from the curve that a 11½ in. center distance and helix angle of 43 deg. 38 min. could have been used. Formula (7) gives 38 deg. 15 min. for the helix angle, and the center distance is then calculated to be 11.36 in. This is the least value of center distance that can be used with the given values of n, N, and P_n; and there is, of course, only one solution for the problem with this center distance.

Helical Gears with Parallel Shafts

The mathematics for helical gears with parallel shafts is similar to that for those with the shafts at right-angles:

$$d_e = d\sec^3\alpha;\ D_e = D\sec^3\alpha$$

$$n_e = n\sec^3\alpha \quad (8)$$

$$N_e = N\sec^3\alpha \quad (9)$$

and $K_e = \dfrac{N_e}{n_e} = \dfrac{N\sec^3\alpha}{n\sec^3\alpha} = \dfrac{N}{n} = K,$

α being the tooth angle, as in the preceding case.

It may sometimes be more convenient to consider these gears in a different way. If the teeth are cut with a cutter of ϕ deg. at a tooth helix angle of α deg., the angle of the involute ϕ when projected on a plane at right-angles to the shafts of the gears becomes something different, ϕ'. Referring to Fig. 6, the value of ϕ' is found as follows: A rack with a face width w has involute teeth of ϕ deg. cut at an angle of α deg. across its face.

$$\tan\phi = \frac{a}{b}. \qquad a = b\tan\phi.$$

$$\cos\alpha = \frac{a}{a'}. \qquad a' = a\sec\alpha.$$

$$\tan\phi' = \frac{a'}{b'} = \frac{a'}{b}. \qquad a' = b\tan\phi'.$$

Equating values of a',

$$b\tan\phi' = a\sec\alpha.$$

$$b\tan\phi' = b\tan\phi\sec\alpha.$$

$$\tan\phi' = \tan\phi\sec\alpha. \quad (10)$$

$\phi' = 16°\ 38'$ for $\phi = 14\frac{1}{2}°$ and $\alpha = 30°$.

The circular pitch P_x in a plane perpendicular to the gear shaft is

$$P_x = P_c\sec\alpha. \quad (11)$$

The addendum is, of course, the same length in both planes, or 0.3183 P_c for standard 14½-deg. gears. Expressed in terms of P_x, the length of addendum becomes 0.2757 P_c for $\alpha = 30$ deg.

From (10) and (11) it is seen that parallel-shaft helical gears cut with 14½-deg. cutters at a tooth angle of 30 deg. are the equivalent of stub-tooth gears with a 16 deg. 38 min. involute when considered in the plane of rotation.

Spiral Bevel Gears

For spiral bevel gears the formulas for bevel and helical gears are combined, as follows:

From (1) and (4), $n_e = n\sec\beta\csc^3\alpha$ (12)

from (2) and (5), $N_e = N\csc\beta\sec^3\alpha$ (13)

and from (3) and (6), $K_e = K^2\tan^3\alpha$. (14)

When $K_e = 1$, (7) becomes

$$\cot\alpha = \sqrt[3]{\frac{N^2}{n^2}} = \sqrt[3]{K^2}. \quad (15)$$

The characteristic movement of the teeth of a helical driver gear over those of the driven gear as the latter is revolved by the former, has been given the name of "sliding" to distinguish it from the "slip" discussed in the previous article, and which is common to all types of involute gears. In this discussion the gear having the smaller actual number of teeth is called the pinion regardless of whether it is the driver or the driven gear. Upon taking up a pair of helical gears and revolving them by hand, it is seen that when the pinion makes one revolution, all of its teeth in contact M_t with those of the gear, slide the equivalent of their full helical length against the teeth of the gear. The gear teeth slide in the opposite direction of the pinion sliding, and of course the same total number M_t of gear teeth slide the pinion teeth, but for only $\frac{n}{N}$ of their helical length, since the gear makes only that fraction of a complete revolution. The total sliding S_{Ts} during one revolution of the pinion is, therefore,

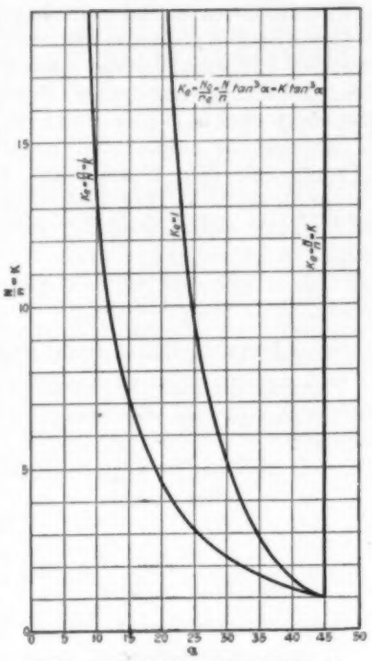


FIG. 4. GRAPHIC REPRESENTATION OF EFFECTIVE RATIO FOR HELICAL GEARS

$$S_{Ts} = \left[M_T h + M_T \frac{n}{N} H \right] \text{in.},$$

where h and H are the lengths of the pinion and gear helices respectively, supposing the face widths of the gears to be wide enough to give the total theoretical number M_T of teeth in contact.

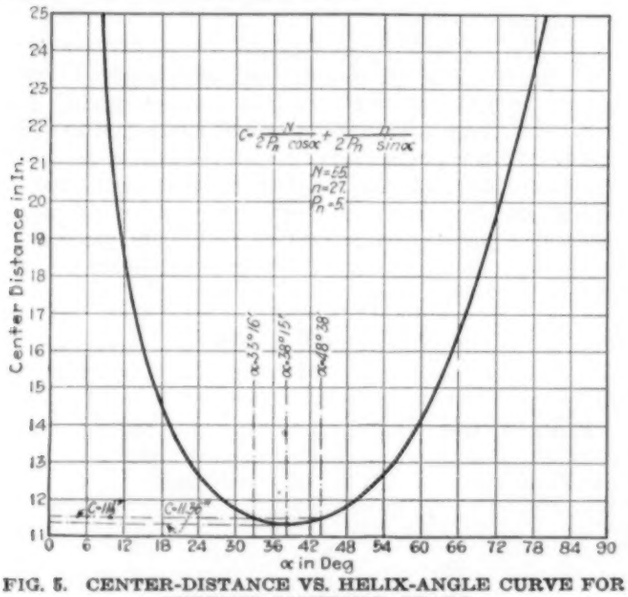


FIG. 5. CENTER-DISTANCE VS. HELIX-ANGLE CURVE FOR TURBINE GOVERNOR GEARS

Substituting these values,

$$h = \pi d \sec\alpha \text{ and } H = \pi D \csc\alpha.$$

$$S_{Ts} = \pi M_T (d \sec\alpha + \frac{n}{N} D \csc\alpha).$$

$$d = \frac{n}{P_n \sin\alpha}; \quad D = \frac{N}{P_n \cos\alpha}$$

$$n = dP_n \sin\alpha; \quad N = DP_n \cos\alpha$$

$$\frac{n}{N} = \frac{d P_n \sin\alpha}{DP_n \cos\alpha} = \frac{d}{D} \times \frac{\sin\alpha}{\cos\alpha}.$$

Substituting this value of $\frac{n}{N}$,

$$S_{Ts} = \pi M_T \left(d \sec\alpha + D \csc\alpha \times \frac{d \sin\alpha}{D \cos\alpha} \right)$$

$$= \pi M_T (d \sec\alpha + d \sec\alpha)$$

$$= 2\pi M_T d \sec\alpha \text{ in. per pinion revolution} \quad (16)$$

Substituting the value of d,

$$S_{Ts} = \frac{2\pi}{12} M_T \sec\alpha \times \frac{n}{P_n \sin\alpha} = \frac{\pi n M_T}{6 P_n \sin\alpha \cos\alpha} \text{ ft}$$

per pinion revolution. (17)

$$S_{Ts} = \frac{\pi n M_T}{3P_n} \csc 2\alpha \text{ ft. per pinion revolution.} \quad (18)$$

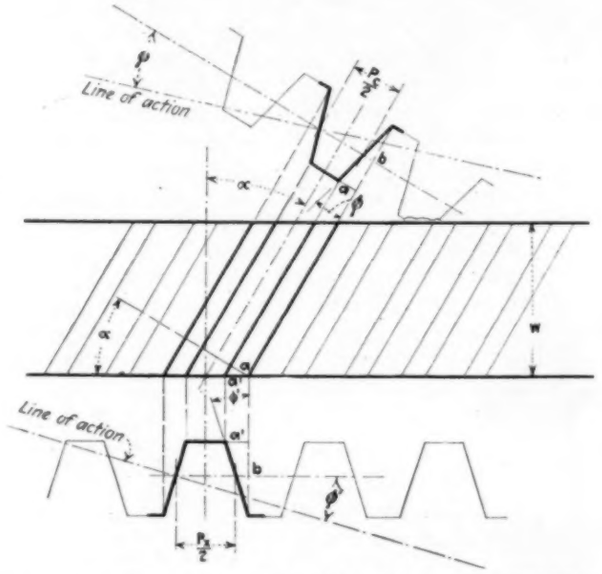


FIG. 6. DIAGRAM FOR DETERMINING ϕ' FOR HELICAL GEARS

The sliding per tooth in contact

$$S_S = \frac{\pi n}{3P_n} \csc 2\alpha. \quad (19)$$

$$P_n = \frac{\pi}{P_c}. \quad S_S = \frac{\pi n \csc 2\alpha}{3\pi/P_c} = \frac{nP_c \csc 2\alpha}{3}. \quad (20)$$

In order to make the sliding a minimum, the smallest possible pitch consistent with strength should be used, also the smallest number of pinion teeth n possible to have, and still avoid interference. Csc 2α is a minimum when $\alpha = 45$ deg., and the smallest practical value of n is, of course, $n = 1$. But, since $n = 1$ cannot always be used with $\alpha = 45$ deg. on account of interference—n and α being mutually inter-dependent in the interference formula—the investigation must be carried still further.

In Fig. 7 formula (19) has been plotted for various values of n and α. The value of S_S when $n = 1$ becomes equal to the least value of S_S when $n = 2$, at $\alpha = 15$ deg. and 75 deg., and is less than S_S for $n = 2$ for all values of α between 15 and 75 deg. There-

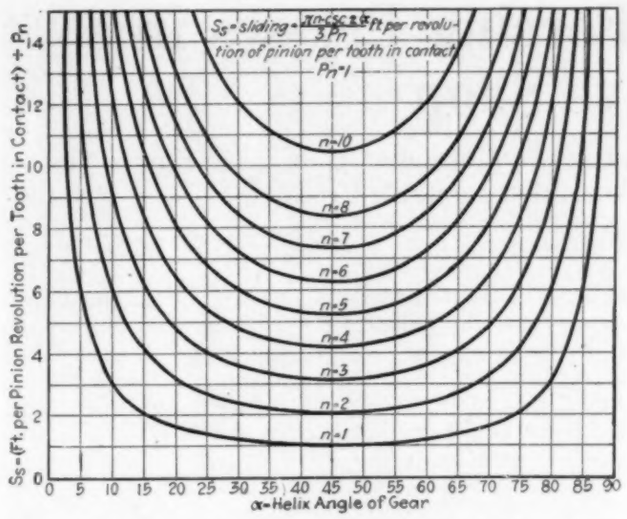

Ss = sliding = (π csc α)/(3 Pn) ft. per revolution of pinion per tooth in contact
Pn = 1
n = 10
n = 8
n = 7
n = 6
n = 5
n = 4
n = 3
n = 2
n = 1
Ss = (ft. per Pinion Revolution per Tooth in Contact) × Pn
α = Helix Angle of Gear

FIG. 7. GRAPHICAL REPRESENTATION OF THE SLIDING OF HELICAL GEAR TEETH

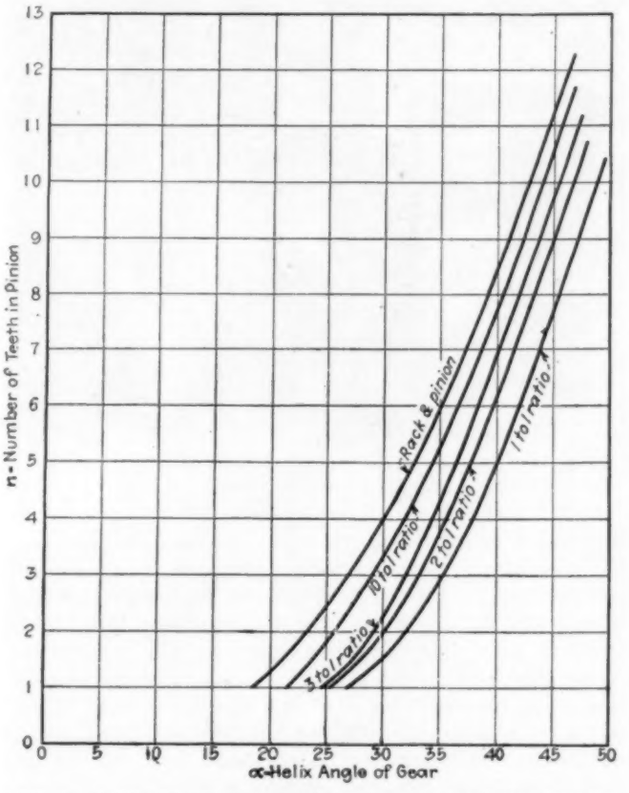


FIG. 8. CURVES TO DETERMINE THE MAXIMUM HELIX ANGLE WITHOUT INTERFERENCE

fore, if $n = 1$ can be used for all gear ratios without causing interference and still keep within the limits of 15 to 75 deg. for α, a theoretical solution has been found for our minimum sliding problem. For highest efficiency and least wear, this theoretical solution should be modified no more than necessary by practical factors in getting a practical design. The sliding can, of course, be greatly reduced by increasing the angle of the involute; or preferably by reducing the length of addendum, or by both methods simultaneously.

The general formula for spur-gear interference is:

$$\frac{N}{n} = K = \frac{n^2\sin^2\phi - 4\pi^2q^2}{4\pi nq - 2n^2\sin^2\phi} \qquad (21)$$

where q = ratio of length of addendum to circular pitch. For standard gears

$$K = \frac{n^2\sin^2\phi - 4}{4n - 2n^2\sin^2\phi}.$$

For spiral gears, K_e and n_e must be substituted for K and n, see formulas (4) and (6).

$$K_e = \frac{n_e \sin^2\phi - 4}{4n_e - 2n_e\sin^2 2\phi}$$

$$K\tan^3\alpha = \frac{n^2\csc^6\alpha\sin^2\phi - 4}{4n\csc^3\alpha - 2n^2\csc^6\alpha\sin^2\phi}$$

$$K = \left[\frac{n\csc^6\alpha\sin^2\phi - 4}{4n\csc^3\alpha - 2n\csc^6\alpha\sin^2\phi}\right]\cot^3\alpha. \qquad (22)$$

For rack and pinion, $K = \infty$, and therefore

$$(4n\csc^3\alpha - 2n^2\csc^6\alpha\sin^2\phi) = 0.$$

$$(2 - n\csc^3\alpha\sin^2\phi) = 0.$$

$$\csc\alpha = \sqrt{\frac{2}{n\sin^2\phi}}. \qquad (23)$$

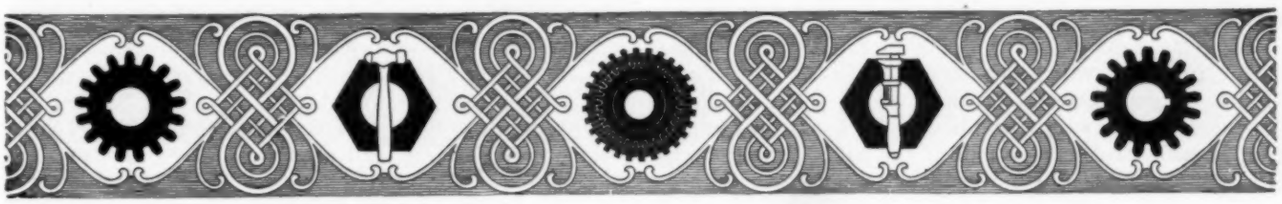
The curves of Fig. 8 have been plotted from (22) and (23). They show the maximum value of α that may be used with a given ratio and value of n without interference.

By substituting n_e and K_e, see formulas (12) and (14), for spiral bevel gears in formula (21), similar minimum sliding curves can be worked out for this type of gearing.

Alaska Code Extended to China

Hon. Charles Sumner Lobingier, judge of the United States Court for China, recently visited the division of commercial laws in Washington and supplied interesting data on incorporating in China under the extension to Americans in China of the Alaska Code. He also contributed valuable information on exterritorial jurisdiction which will be used, in conjunction with other sources of information, in a series of articles on this subject now being prepared for *Commerce Reports* by the chief of the division of commercial laws.

The division has also received a copy of a letter written by Consul General Edwin S. Cunningham, of Shanghai, discussing in detail the character and taxation regulations for incorporating in China under the Alaska Code, as well as a translation of the Chinese companies ordinances for registering companies under Chinese law from Trade Commissioner Lynn W. Meekins. This information will appear as special bulletin CL—8, which may be had by application to the Bureau of Foreign and Domestic Commerce or to its district and co-operative offices.



Hydraulic and Hand Forcing Presses in a Locomotive Shop

A Horizontal Press for Forcing Brasses in Boxes—Method of Using Air Pumps for Boosting Pressures—Self-Contained Portable Press

By J. V. HUNTER

GOOD forcing presses can be of great service in connection with locomotive shop work and some of the different types that prove serviceable are well exemplified in the Beech Grove shops of the Big Four Railroad. The presses here shown were all built in the shop to fill particular needs for which in the unfortunate railroad routine it is frequently impossible to obtain an appropriation for purchase.

The largest press, Fig. 1, is giving satisfaction as a tool for pressing bearing brasses in locomotive driving boxes. This operation is standard practice on this system. The press has two heavy cast-iron heads tied together by four 1½-in. bolts which are covered with pipe sleeves to act as spacers. The heads and cylinder are mounted on a light but suitable base that serves to hold the parts in alignment. The cylinder plunger passes through the upper head *A* and shows at *B*. The cylinder is safely secured to the head to sustain the heavy thrust developed when the plunger is under load.

The booster pump for the hydraulic fluid, mounted on a frame at the left, was made from a standard air pump unit and obtains its power by using compressed air in the steam cylinder. What was formerly the air cylinder handles the hydraulic fluid and in order to obtain a high fluid pressure the cylinder has been bushed down to an inside diameter of 2½ in. and fitted with a piston head to correspond. With full shop air pressure for operating the unit, it is possible to obtain pressures of several hundred pounds per square inch in the fluid chamber.

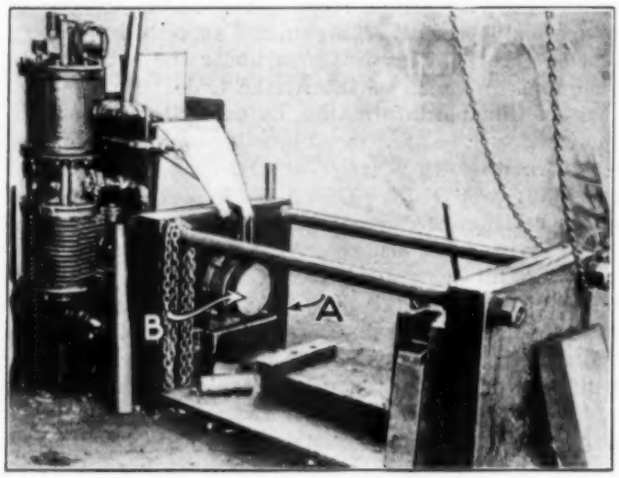


FIG. 1. HORIZONTAL HYDRAULIC PRESS FOR FORCING IN DRIVING BOX BRASSES

The rear view of the press, Fig. 2, shows the pressure cylinder *A*, which has an inside diameter of about 15 in. A counterweight, contained in the case *B*, is provided for drawing the plunger back at the completion of each stroke. The pull of the counterweight acts through the cable *C* running over pulleys to a connection on the front of the plunger head. When the weight draws back the plunger, the fluid is forced back into its reservoir. The illustration shows a locomotive driver-box *D* in position for having a bearing brass forced into place. The shelf *E* fitted over the cylinder is a convenience for holding the can of white lead and other accessories.

The press shown in Fig. 3 is used for forcing bushings and pins from brake levers and other similar pressing operations. It has a heavy cast-iron base on which four pedestals support the upper head with the cylinder. The pedestals are heavy tension rods encased in sections of pipe that support the upper head when there is no load under the plunger. The pressure cylinder has an inside diameter of 6 in. Its upper head is held down by eight ¾-in. bolts, which also pass through the upper head of the press. A coil spring in the cylinder and around the plunger serves to lift the latter and return the liquid to its reservoir after the completion of each stroke.

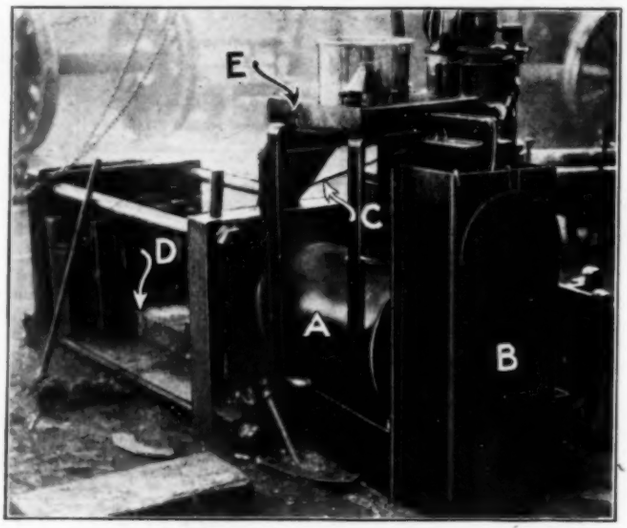


FIG. 2. REAR VIEW OF PRESS SHOWING CYLINDER AND RAM COUNTERWEIGHT CASE

Pipe Fittings Made of Mild Steel

The pressure line *A* extends from the press cylinder to the pressure booster set mounted on a nearby floor column. Unusual fitting are used on this pipe line; they are made of square blocks of mild steel, drilled and tapped to produce fittings capable of withstanding the high hydraulic pressures created in this line. The tank *B* serves as a reservoir for the hydraulic fluid. The suction line from the lower pump cylinder may be seen extending into this tank. Like the booster set previously described, this one was built over from a locomotive air pump, and uses compressed air from the shop line for its motive power. The air cylinder is

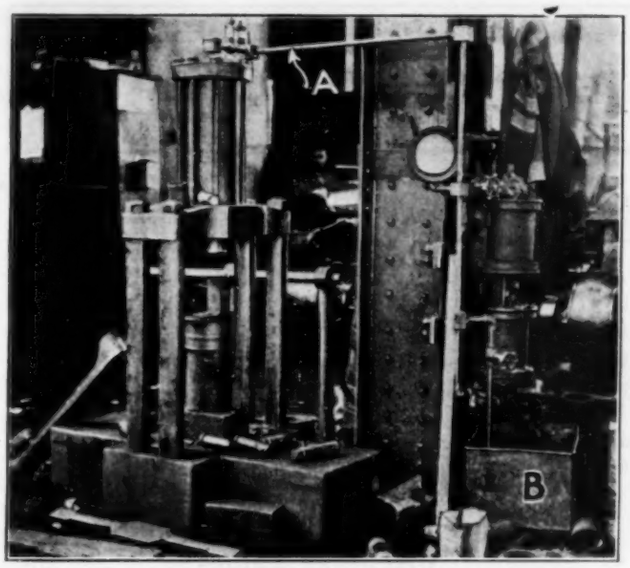


FIG. 3. PRESS USED FOR FORCING BRAKE-LEVER BUSHINGS AND PINS

bushed down to about 2 in. inside diameter so that the booster builds up relatively high fluid pressures.

The press shown in Fig. 4 is somewhat similar in construction to the one previously described, but differs in having its fluid-pressure booster pump mounted on a portion of the frame. Therefore it is practically a self-contained unit and can be transported, as required, to different parts of the shop. Only two pedestals are provided to carry the weight of the upper head, and they again are tension rods inclosed in sleeves. A cast-iron plate is bolted to the base and the

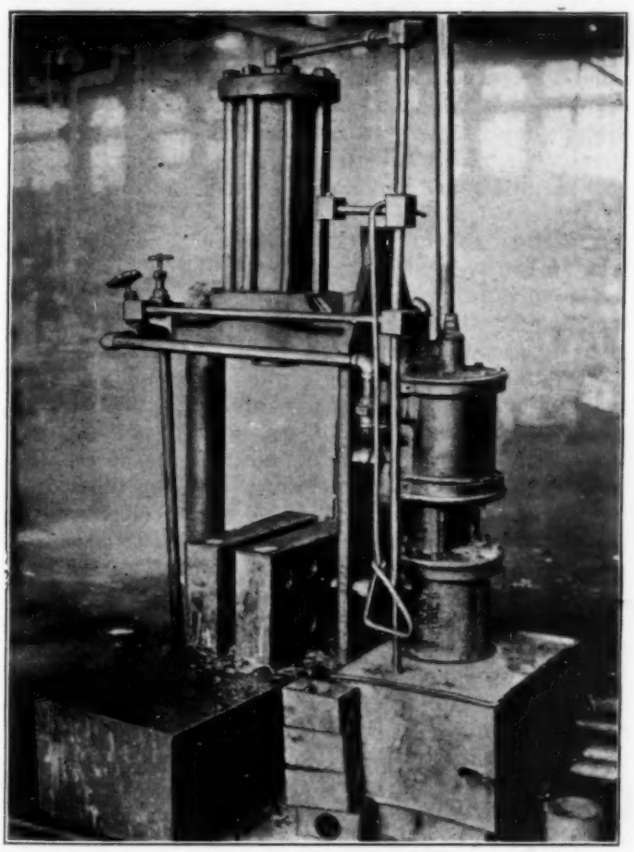


FIG. 4. SELF-CONTAINED PRESS CAPABLE OF BEING TRANSPORTED

upper head and serves as a frame for mounting the pump unit. The pressure cylinder is of the type already described and the high pressure fittings on the fluid line are similar to those used on the press shown in Fig. 3. The pump cylinder is partially submerged in its fluid reservoir, thus insuring greater ease in picking up its suction.

Hand-Operated Forcing Press

The press shown in Fig. 5 is used for forcing out pins and for similar operations requiring the exertion of considerable power. The press has a double gear reduction that greatly multiplies the pressure exerted on the hand lever. The press has cast-iron plates for its base and upper head, held in position by tension

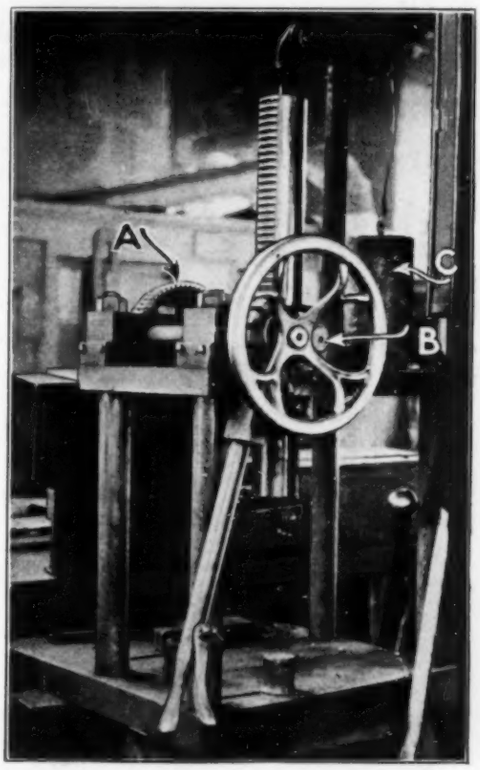


FIG. 5. POWERFUL HAND-OPERATED FORCING PRESS

bolts and spacing sleeves of pipe. The operating lever acts through a ratchet to drive the shaft of the first gear reduction. The gear reduction is located at *A* and the power comes back through the shaft *B* that has bearing supports at both ends and carries the pinion for driving the rack cut on the press ram. The ram is counterbalanced by the weight *C* which draws the ram up after each stroke by means of the cable shown.

This outfit is very convenient for general shop use—so much so that it is almost constantly in service. Work of all kinds is brought to it and the consequence is that it is many times subjected to much heavier work than it is intended for when originally built.

As might have been expected, the results of constant overloading have on several occasions been the breaking of teeth from the rack pinion used in operating the ram. The original pinion and some of the replacements were made of cast iron.

Profiting by the breakages referred to, a pinion is now being made of steel, heat treated, and which it is expected will stand up under any punishment it is likely to receive.

Ideas From Practical Men

Devoted to the exchange of informa ion on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their va.ue are carefully considered and those published are paid for.

Converting a Milling Machine Into a Slotter

By R. Grant

We had more slotter work to do than our slotter would take care of, so it was decided to convert a Becker vertical milling machine into a slotter. The result is shown in Fig. 1.

Briefly it involved removing the vertical spindle and its slide, making patterns and castings for the slide

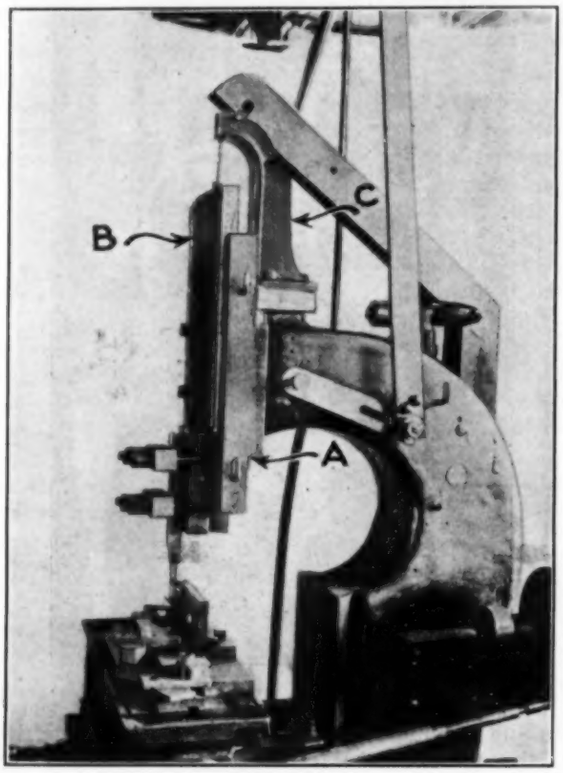


FIG. 1. SLOTTER MADE FROM A VERTICAL MILLING MACHINE

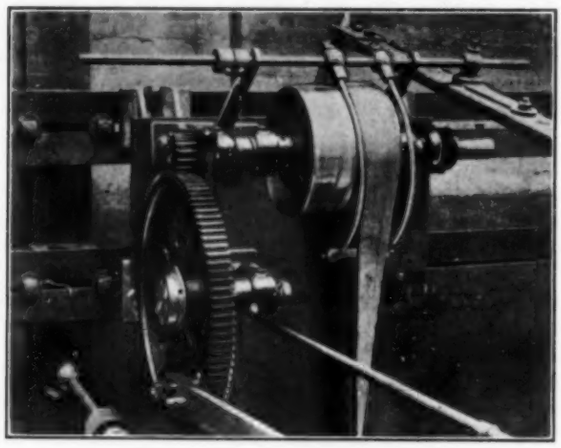


FIG. 2. THE OVER-HEAD DRIVE

A and ram *B*, making a new rack and pinion and several levers. Included in the work, was making the overhead drive shown in Fig. 2 the parts for which were taken from the scrap pile and assembled on a cast-iron plate.

The casting *C* for supporting the counterweight chain also came from scrap and required but little work to adapt it. The cost for labor was about $200.

Depreciation of Machinery and Its Inventory Values

By Martin H. Ball

Believing that the two most common methods of establishing inventory values by charging off a certain per cent of the original cost of a machine tool each year, or charging off a certain per cent of its value on the previous year's inventory date, are the two extremes, has led to the working out of the accompanying table to show a more nearly accurate value of machinery during the various stages of its life for establishing inventory values. To use the table, the useful life of the machine must be determined and its value at the expiration of this period established.

Take for an example a machine that cost $950 delivered at the factory, plus a cost of $50 for installation, making a total cost of $1,000. This machine is considered as being a profitable one for an average of ten years use. At the expiration of that time it not being suitable for further use as a machine tool, it has only scrap value which is estimated at $125 minus the cost of dismantling and carting which would amount to $25, leaving a net value of $100 to be deducted from the original cost of $1,000 and leaving a difference of $900 to be spread over ten years of serviceable time.

The value of the machine at the end of its ten years service of $100 divided by its original cost of $1,000 gives 10 per cent, which will be its percentage value of the original cost at its time of removal estimated as ten years after installation. The method of using the table is as follows:

On the ten-year horizontal line find the percent figures that are the nearest to 10 per cent—in this case it is 10.7 per cent—this determines which column to use for all subsequent percentages.

Now if we wish to ascertain the value of the machine at the expiration of the first year, multiply the original cost of $1,000 by 85 per cent = $850, the percentage figure is found in the column on the line of the first year; or its value after five years, $1,000 × 38.9 per cent = $389, etc.; and at the expiration of ten years $1,000 × 10.7 per cent = $107, which approximates the desired amount.

It would seem that machine tools should be inventoried at their market value with removal charges deducted, and it is obvious that the first year's use of a machine tool reduces its value more than the last year's service. If a percentage of discount figured on the previous

THE EFFECTS AT DIFFERENT RATES OF DEPRECIATION FOR TERMS OF YEARS CALCULATED IN ARITHMETICAL PROGRESSION, ADDING 0.1 PER CENT EACH YEAR FOR THE FIRST COLUMN, 0.2 PER CENT FOR THE SECOND, 0.3 PER CENT FOR THE THIRD, ETC.

Year	Percentages of Value															
1	95.0	94.0	93.0	92.0	91.0	90.0	89.0	88.0	87.0	86.0	85.0	84.0	83.0	82.0	81.0	80.0
2	90.2	88.2	86.2	84.3	82.4	80.5	78.6	76.7	74.9	73.1	71.3	69.6	67.8	66.1	64.4	62.7
3	85.5	82.5	79.7	76.9	74.1	71.4	68.8	66.3	63.8	61.4	59.0	56.8	54.5	52.3	50.2	48.2
4	80.9	77.1	73.4	69.8	66.3	63.0	59.8	56.8	53.8	51.0	48.2	45.6	43.1	40.7	38.4	36.2
5	76.6	71.8	67.3	63.1	59.0	55.2	51.6	48.1	44.9	41.8	38.9	36.1	33.6	31.1	28.8	26.7
6	72.4	66.8	61.5	56.8	52.0	48.0	44.1	40.4	37.0	33.9	30.9	28.2	25.7	23.3	21.2	19.2
7	68.3	62.0	56.1	50.9	46.0	41.5	37.4	33.6	30.2	27.1	24.2	21.6	19.3	17.2	15.2	13.5
8	64.4	57.4	51.0	45.4	40.2	35.6	31.4	27.7	24.4	21.4	18.7	16.4	14.3	12.4	10.8	9.3
9	60.7	53.1	46.2	40.3	35.0	30.3	26.2	22.6	19.5	16.7	14.3	12.2	10.4	8.8	7.4	6.2
10	57.1	48.9	41.7	35.6	30.3	25.7	21.7	18.3	15.3	12.8	10.7	8.9	7.4	6.1	5.0	4.1
11	53.7	45.0	37.6	31.3	26.0	21.6	17.8	14.6	12.0	9.8	7.9	6.4	5.2	4.1	3.3	2.6
12	50.4	41.3	33.7	27.5	22.3	18.0	14.5	11.6	9.2	7.3	5.8	4.5	3.5	2.8	2.1	1.6
13	47.3	37.8	30.1	23.9	18.9	14.9	11.7	9.1	7.0	5.4	4.2	3.2	2.4	1.8	1.3	1.0
14	44.3	34.6	26.8	20.8	16.0	12.2	9.3	7.0	5.3	4.0	2.9	2.2	1.6	1.1	0.8	....
15	41.5	31.5	23.8	18.0	13.4	10.0	7.4	5.4	3.9	2.8	2.0	1.5	1.0	0.7	....	....
16	38.8	28.7	21.1	15.4	11.2	8.1	5.8	4.1	2.9	2.0	1.4	1.0	0.7	....	....	....
17	36.2	26.1	18.6	13.2	9.3	6.5	4.5	3.1	2.1	1.4	0.9	....	....	....	....	....
18	33.8	23.6	16.3	11.3	7.7	5.2	3.5	2.3	1.5	1.0	....	....	....	....	....	....
19	31.5	21.3	14.3	9.6	6.3	4.1	2.7	1.7	1.1	....	....	....	....	....	....	....
20	29.3	19.3	12.5	8.1	5.1	3.2	2.0	1.2	0.7	....	....	....	....	....	....	....

year's value of the tool was used it would require a 37 per cent annual discount to effect the desired reduction in ten years, and the first year's use would lower the tool's value $370 and the last or tenth years' service would only lower its value $5.79. The other method of charging off 10 per cent of its first cost each year gives $100 reduction in value each year throughout its useful life; whereas the method of using the accompanying table reduces this tool's value $150 the first year and $36 the last year, which to the writer's mind shows values that meet average conditions very much closer than either of the other methods mentioned and answers the purpose very well for all except very unusual cases.

This method of figuring is simplified and shortened by reference to the table which has range enough for general use.

Milling a Multi-Threaded Nut

BY RICHARD D. FO :

A fixture for machining a multi-threaded nut was built recently by the Rogers Una-Drive Motor Truck Corporation, of Sunnyvale, Cal. The nut (Fig. 1) is used in a self-locking differential and has cut on its inner surface five-threads of five-eighths pitch. The threads had formerly been cut on an engine lathe but the slowness of the operation made the cost prohibitive. Due to the small inside diameter and the length of the thread, it was inadvisable, if not impossible, to cut the threads with an ordinary milling machine attachment, and the layout shown in Fig. 2, in which a milling fixture is used in conjunction with a small lathe, was built for the job. The fixture which was bolted to the tool-block of the lathe, carried an end mill driven through a pair of bevel gears from a pulley at the end.

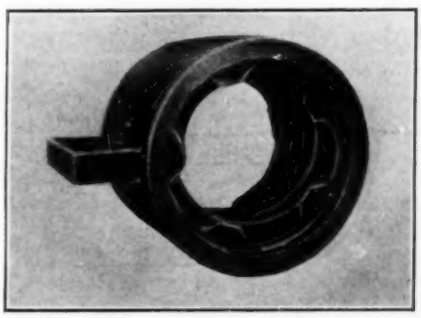


FIG. 1. THE MULTIPLE-THREADED NUT

The whole of the moving parts, with the exception of the cutter and the driving pulley were enclosed in the fixture body. The bevel gears and the cutter arbor (which was mounted in taper bearings to insure rigidity) ran in a bath of oil.

A close-up in Fig. 3 shows the method of supporting the work, one end being held by an index plate and the other end in a special steadyrest. This view also shows the milling cutter projecting from the fixture body.

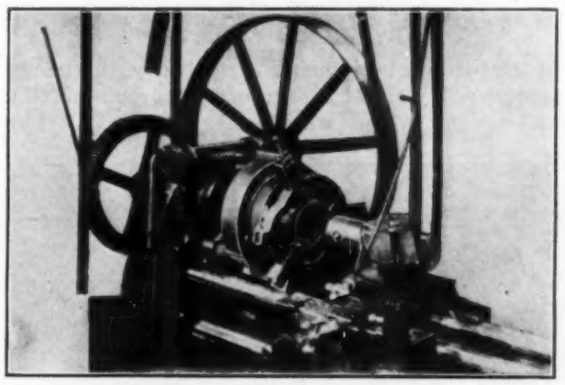


FIG. 2. THE FIXTURE MOUNTED ON THE LATHE

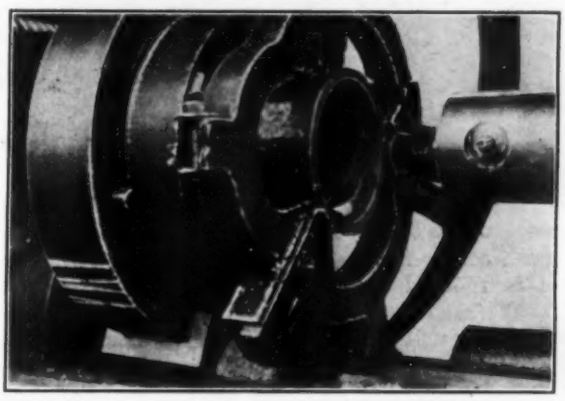


FIG. 3. HOW THE WORK WAS HELD

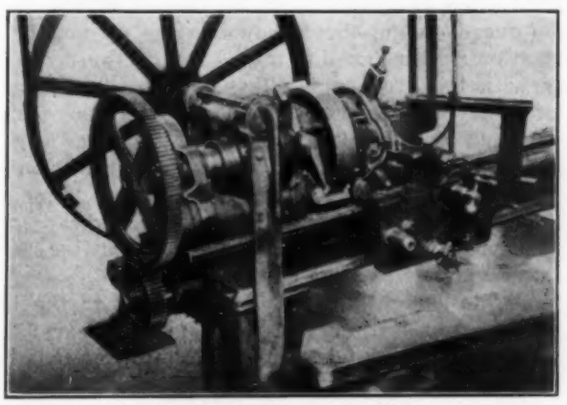


FIG. 4. ARRANGEMENT FOR DRIVE AND FEED

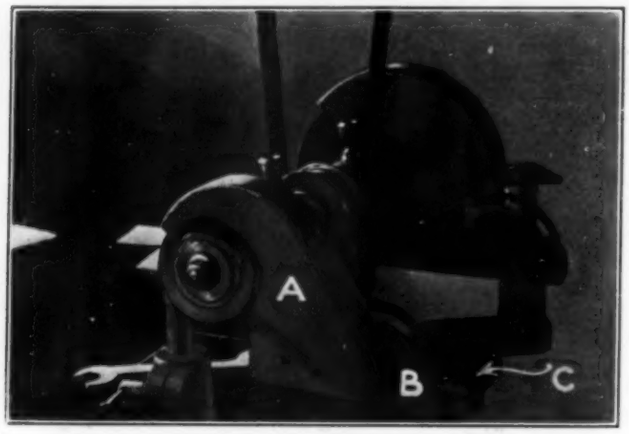
Fig. 4 shows the drive. A worm gear was pressed on one of the steps of the cone pulley, the worm being driven from a line shaft by the large pulley. The worm was mounted on an eccentric which permitted its disengagement for rapid return after a cut had been taken. The ordinary feed gears were dispensed with and three gears as shown drove a special lead screw mounted on the back of the lathe.

Although this arrangement might seem at first sight to be unduly delicate and apt to suffer from vibration and tool chatter, it did not prove so in practice but was satisfactory in every way. The small cutters held up surprisingly well, it being possible to finish a thread in one roughing and one finish cut, the resulting threads being fully equal in finish and accuracy to those cut by the usual methods. In addition to cutting the part shown, the fixture was subsequently used for cutting a quadruple thread worm with equal success.

An Adjustable Wheel-Guard

BY MILTON WRIGHT

The cast-iron wheel guard furnished with the average tool grinding stand is designed to cover a maximum size wheel and, when wheels are new, is not objec-



AN ADJUSTABLE WHEEL GUARD

tionable to the toolmaker; but as it is swung from the same center as the wheel, it follows that when the wheel is reduced in diameter a couple of inches by wear and frequent redressings, the hood will stick out in front and will be an unmitigated nuisance. Under such conditions the hood is quite likely to become "lost" and the operator will again be subjected to the hazard of flying particles of abrasive and to possible serious injury by the breakage of an unguarded wheel.

The guard on the stand shown in the accompanying illustration was designed to meet the objection by doing away with the overhanging lip. The hood *A* is built up of heavy sheet metal by the autogenous welding process and in consequence is not so bulky as a cast-iron hood of equal strength would be. It is also arranged to swivel about a fulcrum near to its lower and rear corner, being held in any position by means of a clamping bolt working in the circular slot in the sector *B* and provided with a substantial wingnut.

Part *C* is a right-angled piece attached to the base of the stand and adjustable in a direction parallel to the center line of the wheel arbor. The sector *B* is held to part *C* by a clamping bolt and wingnut and is adjustable to and from the arbor.

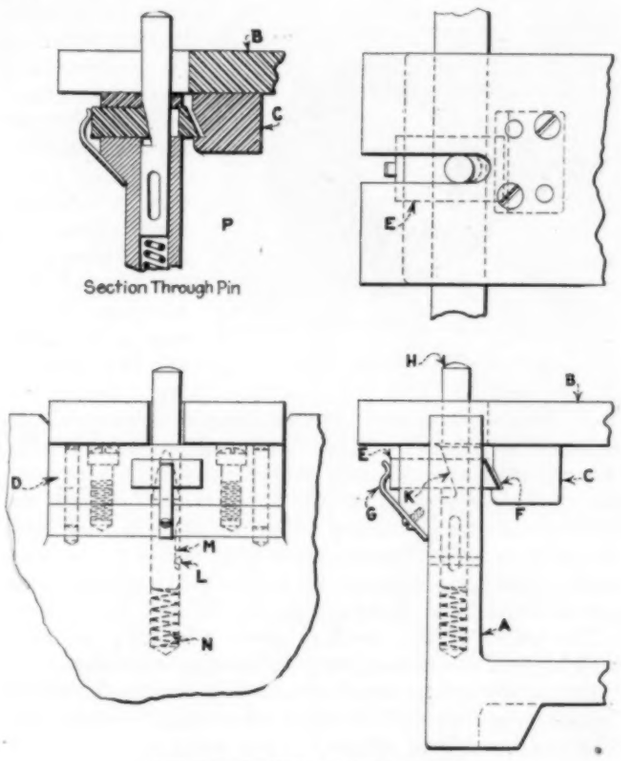
These three adjustments, instantly made with no other tools than the fingers, permit the lip of the hood to lie always close to the periphery, and the side always close to the outer face of the wheel; thus it is not at any time in the way of the operator.

The fact that these guards have been in service for several years without ever being "lost" shows that the average man does not take minor chances when it is convenient for him to do otherwise. If we would change our shop slogan from "safety first," to "make safety convenient," is might not require the exercise of so much executive authority to keep men from being injured.

Self-Locking Leaf Latch

BY GENE PHELPS

The ordinary method of locking the leaf on a jig or fixture is by a screw, tightened by hand after the leaf is brought into a closed position. The illustration shows a self-locking device which is of simple construction and has been used very satisfactorily. At *A* is shown the body of the jig and on the leaf *B* is fastened a latch plate *C*. The plate *D* is located on the body of the jig as shown and acts as a guide for the latch *E*, which is forced into the groove *F* by means of a flat spring *G*. In operation the leaf is brought down until the corner of the latch plate *C* strikes the latch, forcing it back. When the leaf is all the way down, the latch snaps into the groove as shown. In raising the leaf, thumb pressure is applied on the pin *H* which has a tapered flat machined on it at *K* that forces the latch *E* out of the groove, thus allowing the leaf to be raised. The amount of movement of the pin *H* is controlled by the pin *L* which fits in the slot *M*. The spring at *N* keeps the pin in the upward position. The section shown at *P* is taken through the center line of the pin and shows the general construction.



SELF-LOCKING LEAF LATCH

EDITORIALS

National Thrift Week

WITH the anniversary of the birth of the father of thrift in America, Benjamin Franklin, the National Thrift Week inaugurated by the International Y. M. C. A. is with us again. For those whose memory for dates is unreliable, we offer the reminder that Poor Richard was born on the seventeenth of January.

One of the four big aims of this year's thrift week program is to enlist popular support for a national celebration of Franklin's birthday each year. It is not the intention to have the anniversary declared a national holiday, for that would hardly harmonize with the principles of thrift which it is intended to encourage. A program can be worked out later, perhaps by each community; the main thing now is to get the idea accepted.

A second feature of the plan is a concerted drive for the introduction in half a million families of a household budget system. It is common knowledge that only a small percentage of businesses know their costs of production and distribution and it is equally true that the average family is even more ignorant. Here, then, is a fertile field for sane thrift propaganda. Not only will the family be the gainer but the community at large, as well. To indicate the trend of thought in this direction we have only to quote a far-sighted banker who prophesies that within five years it will not be the assets of a business which the banker will scrutinize, but the ability of the organization as indicated by its methods.

What seems to us to be the most immediately productive factor in the campaign is the slogan "Spend time and money wisely." This slogan is put forwar to correct the common misapprehension which regard thrift as miserliness. Real thrift consists of spending nothing unnecessarily, in other words, getting the most for your money and time. Sane spending will start the wheels of industry to turning and aid materially the return of better times.

The fourth point is to enlist 100 cities to carry out the plan of co-operation between schools and banks in explaining to school children the function and operation of banks. This plan was successfully used in Detroit last year and has been adopted by the great mutual savings banks of New York.

The Y. M. C. A. is doing a great public service in its thrift week propaganda and deserves general support. Its ten point financial creed is sound and well-balanced and should be posted in every office and home. We printed it last year and we print it again here:

1. Work and Earn
2. Record All Expenditures
3. Make a Budget
4. Have a Bank Account
5. Carry Life Insurance
6. Own your Home
7. Make Your Will
8. Pay Your Bills Promptly
9. Invest in Safe Securities
10. Share With Others.

Saving Money by Buying Books

IS THERE anything new under the sun? An ancient saw tells us that there isn't and sometimes we are inclined to believe it. The hard-working editor who passes on the practical letters which form so useful a section of the AMERICAN MACHINIST is entirely convinced of it.

Certain "kinks" are sure to be reinvented by every apprentice as he reaches a given stage in his training. He is perfectly sincere in believing that his discovery is original with himself. And so it is as far as he is concerned. Unfortunately, generations of machinists before him have made use of the same short cut and he could have saved himself the pains of giving birth to an idea by reading a technical book.

This is a homely example but the principle applies equally to other cases. Any number of parallel research investigations have been and are in progress which need never have been undertaken had those responsible consulted the leading technical literature on the subject.

If the art of printing is largely responsible for the development of modern civilization then by the same token our present industrial achievements depend in some measure on our technical books. A well-stocked library of such books easily pays for itself in time saved and may be the means of saving large sums of money that would otherwise be wasted in needless duplication of effort.

Local Interest in Aviation Needed

THE growth of commercial air travel in this country, even though small as compared with that of the European air lines, is nevertheless encouraging. If we consider that practically all of the European lines depend upon subsidies for their existence, while ours have been developed without it, we have even more reason to be proud of our pioneers in this line. When it comes to actual miles traveled and the regularity and reliability of service, the United States Air Mail is acknowledged as the model for the whole world.

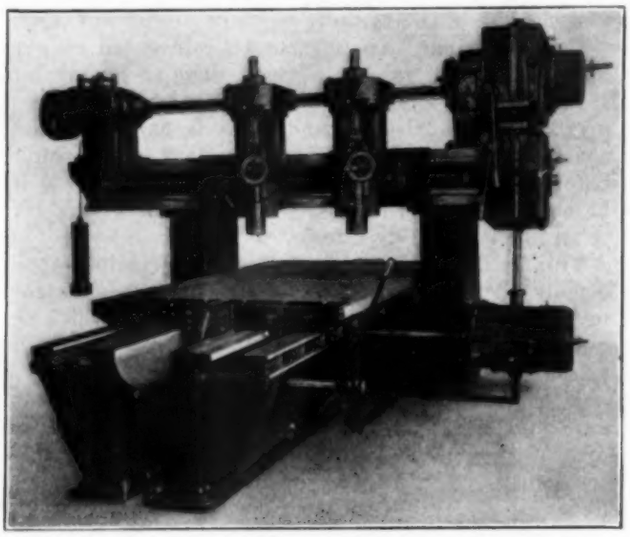
Air travel has become very safe indeed, as statistics will show. It will be safer as new landing fields are provided for emergency landings in cross-country flying. And here is where every live community can do its part in promoting commercial aviation. A standard landing field of suitable grade can be provided and properly marked and will do much to put any town on the map so far as aviation is concerned. In most places the best local garage can furnish supplies and assistance when required, and this will tend to raise the character of the garage as well.

The passage of the bill now before Congress for controlling air navigation will be a step in the right direction. But more than all we need an awakening of the spirit of aviation in every locality. This coupled with a will to do as much as possible, will soon result in landing fields, and then will follow the development of airplane routes, and the regular air service so very much needed in this country.

Shop Equipment News

Beamen & Smith Manufacturing Planer-Type Milling Machines

A large vertical double-spindle milling machine for manufacturing purposes has recently been completed by the Beaman & Smith Co., Providence, R. I. The machine



BEAMAN & SMITH VERTICAL DOUBLE-SPINDLE MANUFACTURING MILLING MACHINE

is of the planer type with a fixed crossrail, upon which are mounted two independent heads that may be used separately or simultaneously, each having power feed.

The width between the housings is 64 in. The table is 60 x 96 in. in size with a traverse equal to its length, and is supported upon four bearing surfaces, to be seen in the accompanying illustration. The spindles have a vertical movement of 12 in. Power feed varying from 1 to 8 in. per minute is available for all movements, the variation being effected through the medium of a gear box. The drive to the spindles is through steel worms on the transverse shaft, meshing with bronze worm-wheels on the upper end of each spindle.

In addition to the feed movements, there is a quick traverse for each movement, the speed of this traverse being constant and entirely independent of the feed. Three conveniently placed levers upon the operating side of the machine control all movements, thus enabling the operator to bring any portion of the work under its respective cutter, lower the cutter to the work, and throw in the feed, all without moving from his position. A handwheel on each head provides an additional quick vertical movement of the spindles when setting up.

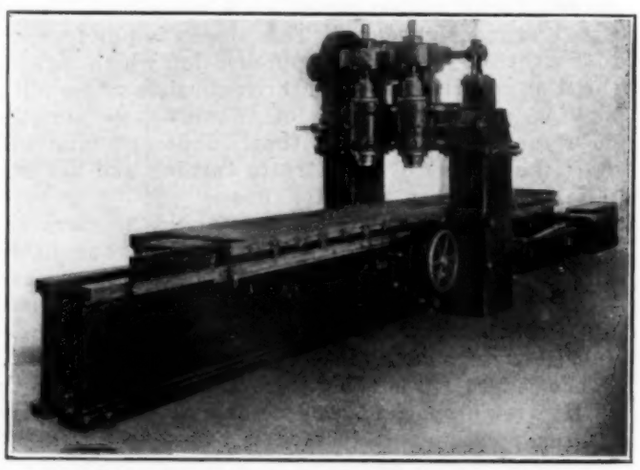
The spindles run in long bronze bearings that give rigidity and provide means of compensating for wear. The weight of the spindle is borne by an adjustable ball bearing that at all times holds the working thrust surfaces in contact and prevents the spindle from "jumping" as the cutter enters or leaves the work. Inserted-tooth cutters 10 in. in diameter are used. The weight of the machine is approximately 50,000 lb., and it covers a floor space of 11 x 16 feet.

A manufacturing milling machine, intended especially for spot milling long castings upon which the surface to be machined is all in one plane but is not continuous, has recently been built by the Beaman & Smith Co. This machine, also, is of the planer type and carries two heads.

The table of the machine is 24 in. wide by 14 ft. long, and has a power feed covering the full length of travel. The crossrail is fixed and the two spindles mounted thereon have a vertical adjustment of 6 in., but are not provided with power movement. The machine is distinctly a single-purpose tool, and its dimensions and capacities are designed in each case for the work it is to do.

The special feature of the machine is the "jump," or intermittent, feed, that is controlled by a series of adjustable cam dogs, shown in the accompanying illustration on the edge of the table, corresponding in position to the reverse dogs of a planer. These cams may be set to cause the table to feed slowly for any definite distance while a cutter is at work; and then, when that surface is finished, to move rapidly on to the next space to be machined. The change from slow to fast movement, and *vice-versa*, may be made by each pair of cams along the edge of the table.

The cutter spindles run in bronze bearings that are adjustable to compensate for wear. The weight of each spindle is borne by a ball-thrust bearing that prevents any downward movement of the cutter as it passes out of a cut. The spindles are positively driven through helical gearing. Taper-shanked cutters are used. A draw-bolt



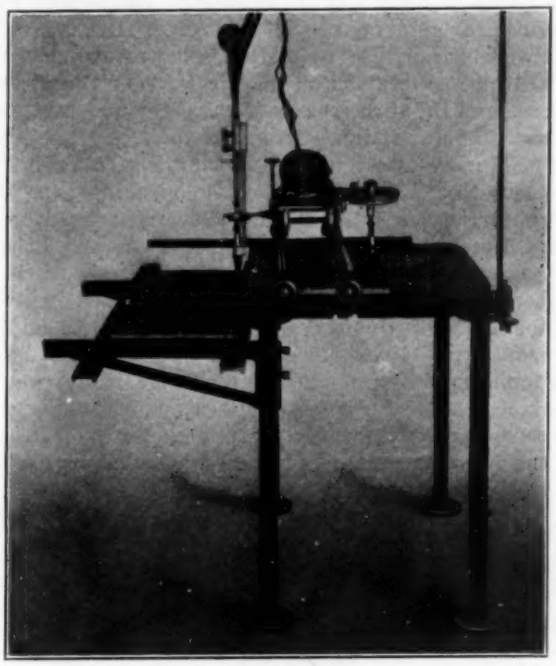
BEAMAN & SMITH PLANER-TYPE MILLING MACHINE

passing through the hollow spindle holds the cutter to its seat, and a driving wing relieves the shank of any torsional strain.

A gear box provides a convenient means of changing the rate of feed, and a pair of three-step cones and belt permit the rate of quick traverse between cuts to be varied to meet the requirements of the work. The machine is built upon the unit plan, and can be furnished with its principal dimensions to suit any piece that is to be machined in quantities.

G. W. & E. Automatic Cutting Machine

The General Welding & Equipment Co., 74 Brookline Ave., Boston, Mass., has recently placed on the market the "Gewe" automatic cutting machine shown in the accompanying illustration. The machine is intended for the cutting of metal parts, such as dies, cams, crankshafts and drop forge tools directly from the steel plate, being especially adapted to large production. The



"GEWE" AUTOMATIC CUTTING MACHINE

machine consists of two carriages, one mounted on the other, so that it is possible to reach any point of the work. The upper carriage supports on one side a cutting torch of the usual oxygen-acetylene type and is mounted in an adjuster for obtaining the proper position. On the opposite side, the carriage supports the driving and the tracing system. There are no intermediate linkages between the tracing and the cutting systems, so that any movement on the pattern is transmitted directly to the torch cutting the plate.

On top of the carriage is an electric motor transmitting its power through a friction wheel running on a disk on the shaft carrying the tracer roller. A template made of fiber and having the outline grooved in it that it is desired to cut in the work, must be used. The tracing roller follows in this groove. The driving shaft carries a collar loaded by spring pressure and having a knurled conical end at the bottom. This knurling rests on the edge of the groove in the template and obtains the traction necessary for driving the apparatus. When the driving shaft is rotated, the driving member runs along one inclined face of the groove in the template, and presses the tracing roller against the other side of the groove. In this way, constant engagement of the driving member and of the tracing roller is insured, giving uniform speed and smooth motion.

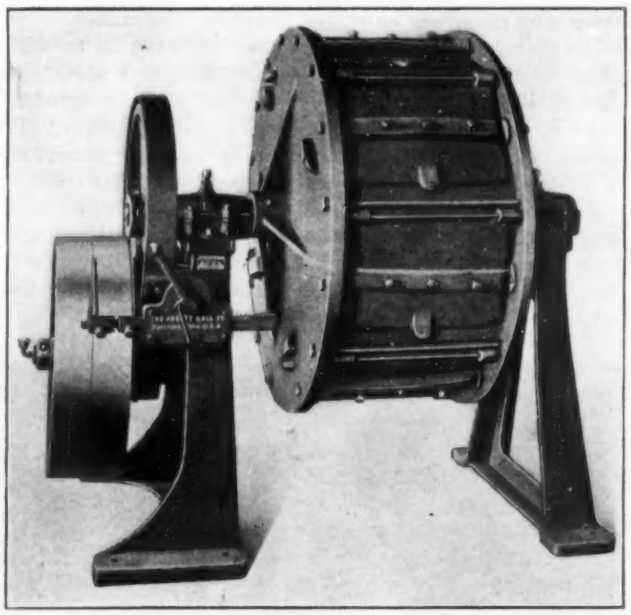
The speed can be regulated either electrically by a rheostat or mechanically by changing the position of the friction wheel on the disk. Any possible variation in height of the driving members due to unevenness of the templates is not transmitted to the torch, due to the construction of the members on the driving shaft. Movement to any part of the horizontal plane is obtained without jumping, jerking or stopping at the corners, a feature which enables the obtaining of a very smooth cut on the work.

The templates used are made of a soft material such as fiber. They can be cut by means of a special milling tool, driven if desired by an ordinary drilling machine. The templates are stated to be very quickly prepared, and to serve for the cutting of hundreds of metal plates. The torch may be operated on either oxygen and hydrogen, or on oxygen and acetylene. The speed of cutting varies from 18 in. per min. for ½-in. stock to 7 in. per min. for stock 4 in. in thickness. The machine is made in two sizes, one having a capacity for work 12 x 12 in. in size, and the other for work 24 x 24 in. The latter machine is illustrated herewith.

Abbott Burnishing Machine

The burnishing machine shown in the accompanying illustration has just been placed on the market by the Abbott Ball Co., Hartford, Conn. The chief feature of the machine is that the articles to be finished are not put into the barrel loosely and allowed to tumble in the mixture of balls, soap and water. The work is held stationary on the inside of the barrel body and as the barrel rotates, the parts are carried through the cleaning mixture. In this way, large parts can be finished without danger of injury due to the striking of one piece against another.

The periphery of the barrel has eight sides, each one having a hand hole provided with a hinged cover. The edges of the openings are beveled, so that the inside cover plates fit them tightly. There are two springs on the back of each plate against which the hinged cover



ABBOTT BURNISHING MACHINE

presses. The hinged cover has packing around the edges, so that when the clamping bar is in place on top of it the opening may be made water-tight.

Fixtures for holding the work are fastened to the inside of the cover plate. Since the machine is intended for handling work in large quantities, several sets of cover plates and work-holding fixtures are usually pro-

vided for each machine, so that while unloading one set of fixtures and putting fresh work into them, the machine may be operating with another set in place. When the work is finished, instead of dumping all of the balls from the barrel, it is merely necessary to remove the cover that is at the top of the barrel, take out the fixture and replace it with a fresh one. By bringing the next hole to the top, the operation can be repeated until a new batch of work has been put in every hole.

When handling work that is to be plated, it is said that three sets of fixtures should be used, so that when the work comes out of the barrel it may be left in place on the fixtures, put through the plating operation, and then brought back to the burnishing barrels for the final finishing.

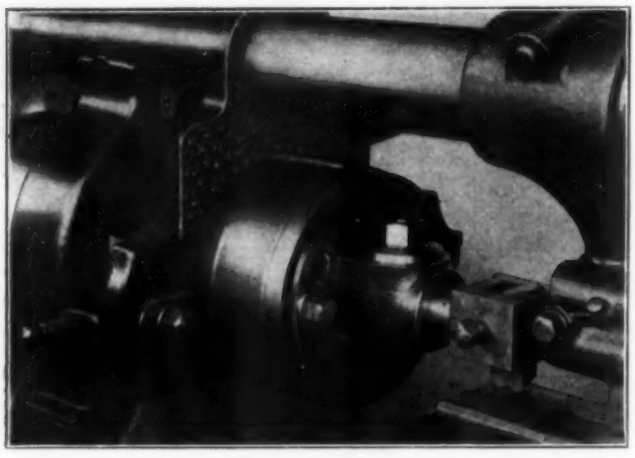
When it is desired to clean out the interior of the barrel without removing the balls, a straining cover may be placed over one of the holes, the barrel filled with water, and the dirt washed out by running the machine.

Dover Fly-Cutter Holder for Milling Machine

The fly-cutter holder shown in the accompanying illustration is intended for toolroom use in making the manifold form cutters that are required as part of the equipment of screw machines, or in the making of certain forms of small dies. It is made by the George W. Dover Co., Inc., Providence, R. I., and is designed to fit over the spindle nose of a milling machine and clamp to the face of the column.

The inner end of the arbor is tapered to fit the spindle hole of the machine to which the device is to be adapted, and has a bearing in a bronze sleeve housed in the frame of the device. The yoke to take the fly-cutter has a large round hole, to which is fitted a round bushing with an open slot machined to fit the shank of the cutter.

As it is customary in this class of work to take the final cut of 0.001 or 0.002 in. with the cutter stationary and acting as a planing tool, the device is so arranged that by releasing the taper shank and tightening the large hexagon nut, the arbor may be held stationary with the cutter in any desired position. The casting which carries the bearing sleeve can be swiveled to an angle of 20 deg. either way, and is graduated to facilitate the angular setting when planing such work as master tools. When so used, the regular power feed of the milling-machine table is available.

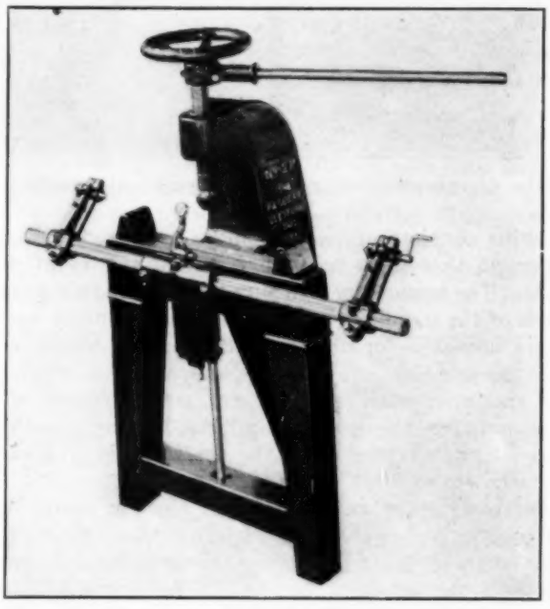


DOVER FLY-CUTTER HOLDER

Geier No. 2P "Production" Straightening Press

In the accompanying illustration is shown a straightening press recently put on the market by the P. A. Geier Co., Cleveland, Ohio. The press is particularly adapted to production work on parts such as crankshafts. It is supported on three legs, the top of the bed being 30 in. above the floor. The press is of the screw type, both a lever and a graduated handwheel being provided for applying the driving force. By turning the handwheel through $\frac{1}{15}$ revolution, a downward movement of 0.010 in. is obtained on the screw. The throat depth is 4 in., and the thrust block of the screw has a range of from 2 to 8 in. distance from the table.

The work is straightened without removing it from the centers. At the front of the machine is a shaft carrying the center points and fitted to a head having roller bearing. This shaft can be freely moved either to the right or to the left, so as to bring the work in the proper position. The head carrying the shaft is pivoted to the body of the press, and is normally held in a horizontal position by means of a vertical shaft having a compression spring on each side of it. A vertical movement is also provided, the head being supported by means of a spring enclosed in the rear leg and connected to the head by means of a cable. An adjustable stop



GEIER NO. 2P STRAIGHTENING PRESS

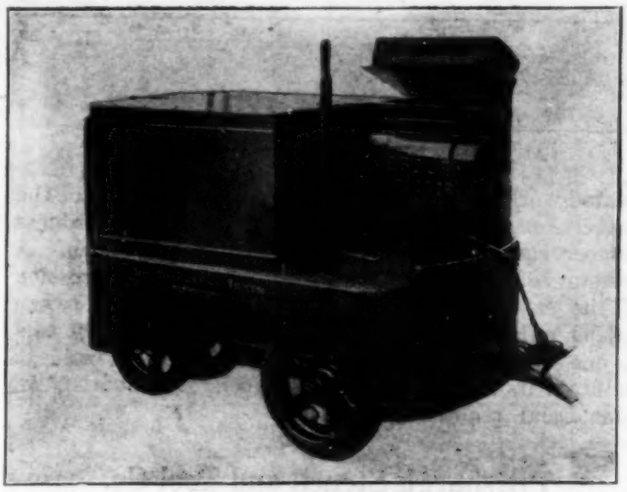
screw is provided so that the position of the work can be properly adjusted.

The press is equipped with a dial indicator having a stroke of $\frac{1}{4}$ in. It is thus possible to very easily read the eccentricity of the work. The maximum distance obtainable between the center points is 40 in. For the handling of longer work, the rollers mounted above the center points are used, it thus being possible to hold a shaft 3 ft. long by $2\frac{1}{2}$ in. in diameter. Two pairs of thrust blocks are furnished, one for use when the work is on centers and one when it is used on the rollers. The blocks can be adjusted along the bed, which is 26 in. in length. The floor space is $22\frac{1}{2}$ x 82 in., the maximum height from the floor to the handwheel is $55\frac{1}{2}$ in., while the net weight is 500 lb.

Mercury Type-K Tractor

The Mercury Manufacturing Co., 4118 South Halsted St., Chicago, Ill., has recently placed on the market the small industrial tractor shown in the accompanying illustration. The machine, designated as the type K, is intended particularly for light work in close quarters. Being only 29 in. in width, it can be operated through doorways of the ordinary size. Its over-all height is 48 in., and its over-all length 56 in.

The position of the operator is at the rear of the tractor, the seat being placed at one side. In this way, it is possible for the operator to drive with equal facil-



MERCURY TYPE-K TRACTOR

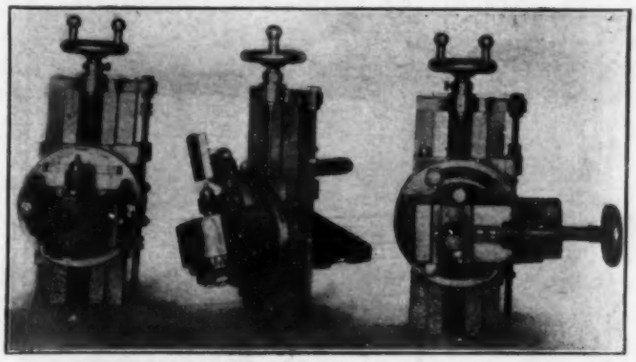
ity in either direction. The operator may uncouple the trailers without leaving his seat. Because the wheel base is only 30½ in., the tread 23¾ in. and the outside turning radius only 57 in., the tractor may be used in crowded and narrow aisles, the trailers being arranged, of course, to follow in its tracks.

The frame is a semi-steel casting, the hood being sheet steel reinforced by angles and riveted to the frame. The machine carries 21 Edison cells or 12 cells of the standard lead-plate type. A General Electric motor operating on 24 volts and 50 amperes at 1,500 r.p.m. is used, the drive being through worm gearing to the rear axle. The drum-type controller gives three speeds forward and one reverse. The brake is of the contracting-drum type and operated by a foot pedal. The machine has a normal draw-bar pull of 400 lb., with a maximum of 650 lb. The speed when running light is about 6 miles per hour.

Dover Milling Attachment for Lathe

A device intended to be bolted to the toolblock of an 18-in. engine lathe for the purpose of doing such small milling work as the fluting of taps and reamers and cutting teeth in small cutters, has recently been placed on the market by the George W. Dover Co., Inc., Providence, R. I. As shown at the left side of the accompanying illustration, the device is supported in a vertical position with the dividing head below the line of the lathe centers, and is used in connection with suitable cutters held upon an arbor between the lathe centers.

The dividing head is mounted on a swiveling plate that can be set to any angle up to 20 deg. on either side of the vertical position, the edge of the plate being graduated to facilitate setting. The dividing head may



DOVER MILLING ATTACHMENT FOR LATHE

be removed by the withdrawal of two bolts, and the small vise seen in position at the right of the accompanying illustration, substituted. The spindle of the dividing head has a taper hole to receive the shank of a chuck or other holding device. A set of index plates cut to give all the most commonly used divisions is keyed to the lower end of the spindle, and these plates may be changed for others by removing the knurled binding screw.

A bolt, the head of which may be seen through the hole in the shell in the view at the left, serves to lock the spindle rigidly in any position irrespective of the index pin. The spindle terminates at the upper end in a flat plate that effectively covers the bearings and excludes oil and chips. For the class of work to which the device is adapted an outboard center is rarely needed, but provision is made for attaching a V-block in any angular position for the purpose of supporting slender work against the pressure of the cut, as in the central view.

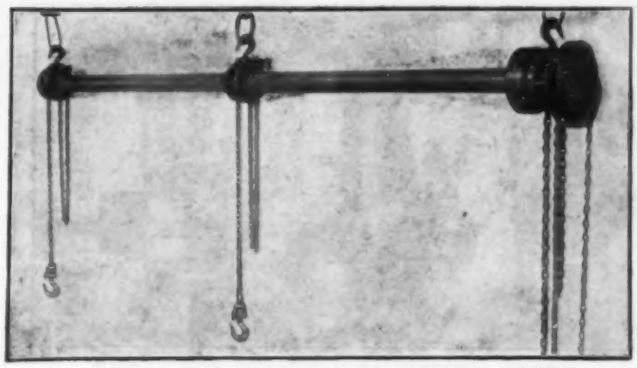
The elevating screw is of fine pitch and, in conjunction with the graduated collar, may be depended upon for vertical adjustments to 0.001 in. The slide may be clamped in any position, and the limit nuts upon the threaded bar on the right enable the operator to back the work away from the cut for inspection and to return it to the cutting position with certainty. The nuts also serve as stops when cutting to depth. The device is not intended as a substitute for a milling machine, but is for use in shops where the range of milling work is limited and where no small machine for doing this class of work is available.

Wright Triple-Hook Hoist

The Wright Manufacturing Co., Lisbon, Ohio, has recently placed on the market the triple-hook hoist shown in the accompanying illustration. The three hooks are operated simultaneously by means of one hand chain, being intended for the lifting and conveying of flexible materials such as bundles of long wires, metal bars, tubes and sheet metal, the three-point suspension preventing undue sagging.

The three lifting hooks are connected by lengths of pipe, and are ordinarily placed 5 ft. apart, although this distance may be varied to suit the requirements. The hoist shown has a capacity of 1 ton, although it can be furnished in larger sizes. The hoist is ordinarily suspended from three ½-ton plain trolleys running on an overhead I-beam. The high speed feature of the hoist enables the speedy lifting of the load.

The hoist is submitted at the factory to an overload 50 per cent in excess of its rated capacity, so as to insure sufficient strength. The main drive shafts and



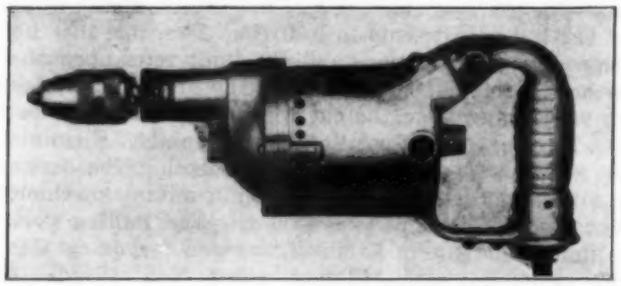
WRIGHT TRIPLE-HOOK HOIST

pinions are made of nickel-steel forgings, the load-chain wheels of electric-furnace steel castings, and the housings of malleable iron. The construction is stated to give great durability and strength.

U. S. Electrical Tool Co. "Buzz" Drill

The United States Electrical Tool Co., Cincinnati, Ohio, has recently placed on the market the portable electric drill shown in the accompanying illustration. The machine is known as the Buzz drill, and is intended both for metal drilling and wood boring. The motor is of the universal type and capable of operation on either direct or alternating current. The casing is made of aluminum, in order to save weight. The controlling switch is located in the handle and is operated by the finger, so that the tool may be easily controlled.

The gears used in the drill are made of hardened chrome-nickel steel, and run in grease in a chamber



U. S. BUZZ DRILL

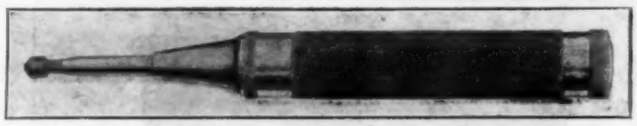
entirely separated from the motor windings. The spindle is fitted with ball thrust bearings, and has an operating speed of 1,100 r.p.m. The weight of the drill is 6 lb.

Punch for Making Hardness Tests

The Case Hardening Service Co., 2283 Scranton Road, Cleveland, Ohio, has recently placed on the market a small portable instrument for the making of hardness tests on the Brinell principle. The device is known as the Auto Punch, and is manufactured by the Rudge-Whitworth Co., London, England. It is made in two sizes. The 12-in. size shown in the accompanying illustration is intended primarily for all work on steel, iron and hard metals, while the 6-in. size is for use with sheet-brass and thin metals.

Inside the barrel is a spring-loaded hammer, while a steel ball is carried inside a cap at the bottom. To operate, the knurled barrel of the punch is gripped in the hands while the ball is in contact with the work. By pressing down on the barrel, the spring hammer is released and strikes the ball, the force of the blow making a depression in the work. The size of this depression is then measured, just as in the ordinary Brinell test. The piece to be tested must rest on a solid support, such as a bench block. The portability of the device is its chief feature, as it can be brought to the work. Large bodies of metal can be tested in position, an example being the flanges of car wheels.

The hardness of steel plate, stampings, forgings and castings can very easily be determined by means of the device, as well as that of case-hardened and heat-



AUTO PUNCH FOR HARDNESS TESTING

treated work. The relation between the diameter of the impressions given by the punch and the Brinell hardness number can easily be established for each punch. A pressure of 850 kgs. on a ½-in. ball gives a depression of the same size as that of the 12-in. punch when testing mild steel. The 6-in. punch can be easily held in one hand when operating. The device is said to maintain its accuracy with use sufficiently to satisfy all commercial requirements.

Pittsburgh Stencil and Tool Co. "Temperite" Tool

In the accompanying illustration is shown a device recently placed on the market by the Pittsburgh Stencil and Tool Co., 40 Water St., Pittsburgh, Pa., for use in determining the proper hardening heat for carbon steel. The principle of operation of the device is based upon the fact that ordinary carbon steel attracts a magnet as long as it is under the correct hardening heat, but that as soon as this heat is reached the steel has no magnetic attraction.

The device, known as the "temperite" hardening tool, consists of a balanced and insulated magnetic tilting bar mounted on the end of a rod. The bar is made of a special steel that enables it to retain its magnetism better than an ordinary magnet, not being affected to any great extent by the heat.

In operation the steel under treatment is heated slowly and tested occasionally with the "temperite" tool by

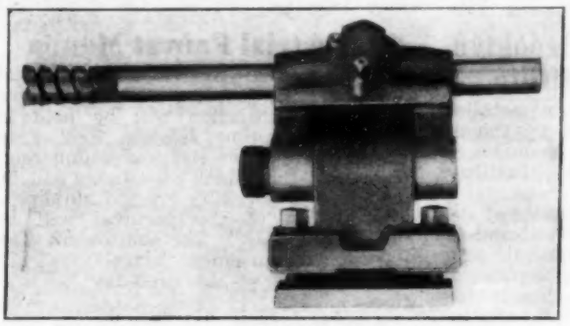
PITTSBURGH "TEMPERITE" HARDENING TOOL

merely bringing the magnet close to it. The bar will tip until the correct hardening temperature has been reached, at which point it is no longer affected. The work is then quenched quickly, and should result in a perfectly hardened tool. The magnetic bar is kept cool by dipping it frequently into water, and when not in use its magnetism is retained by placing a keeper on it, thus lengthening its life.

Dover Swing Boring-Tool Holder

The boring-tool holder shown in the accompanying illustration has recently been placed on the market by the George W. Dover Co., Inc., Providence, R. I. The tool is intended to combine maximum rigidity with a wide range of adjustment. It is held to the toolblock of the lathe by means of two bolts and a strap that fits in the T-slot in place of the toolpost. The bearing about which the swinging member turns is parallel with the bar, and thus no amount of adjustment affects the parallelism of the cutter bar with the lathe spindle after it has once been set. By tightening the bolt the swing member may be held in any position to which it is adjustable.

The hold upon the bar is secured by means of a yoke that is drawn up by means of a large hexagon nut. The



DOVER SWING BORING-TOOL HOLDER

yoke encircles the bar and, when tightened, gives a very rigid grip upon the latter. The square-head adjusting screw that may be seen in the swinging member is provided so that the bar may be swung back out of the way for inspecting or calipering the work and returned to position with certainty, in case it is necessary to repeat a cut.

The Dover double-lipped bar is supplied with the device, thus enabling the operator to make two grindings at each trip to the grinding wheel.

Millersburg Helical-Flute Expansion Hand Reamer

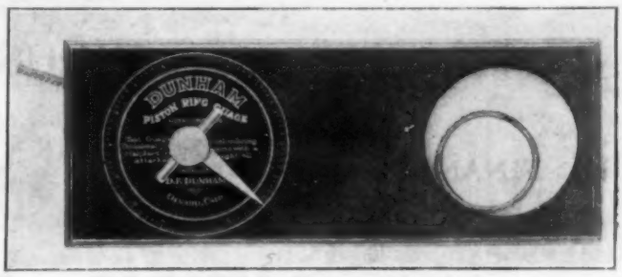
The Millersburg Reamer & Tool Co., Millersburg, Pa., has recently placed on the market the helical-flute expansion hand reamer shown in the accompanying illustration. The device is furnished in all sizes up to 2½ in. in diameter. The helical flutes enable the producing of smooth and clean-cut holes that are accurate in size, these results being due to the shearing action of the blades, and to the elimination of chatter. The tool is stated to cut freely and easily and to have great strength and durability.

The expansion feature of the tool gives it a much greater life at its original size than is the case with a solid tool. The blades may be expanded to compensate for wear and resharpening, thus maintaining the original size. The maker states that with the tool, 30 to 40 per cent more work can be turned out than when using a straight-fluted reamer.

MILLERSBURG HELICAL EXPANSION REAMER

Dunham Piston-Ring Micrometer

D. F. Dunham, Oxnard, Cal., has recently placed on the market the micrometer or gage shown in the accompanying illustration for automotive piston rings. The



DUNHAM PISTON-RING MICROMETER

device is intended for use in piston-ring factories and in jobbing houses handling piston rings, being also adapted to shops where a stock of rings is handled and cylinder regrinding and repairing are done.

The micrometer is composed of a steel tape secured at one end to a pin and attached to a brass rack at the other end, the rack operating on a pinion. The piston or piston ring to be gaged is placed within a loop of the steel tape in the opening at the right, and the handle at the left is revolved so as to move the rack and tighten the tape on the ring. Rings from 2⅜ to 5⅛ in. in diameter can be gaged, the size being indicated to 0.001 in. on the dial at the left. Since the pressure on the tape closes the ring, its exact size can be easily and quickly determined.

Pittsburgh Stencil and Tool Co. "Super" Steel Stamp

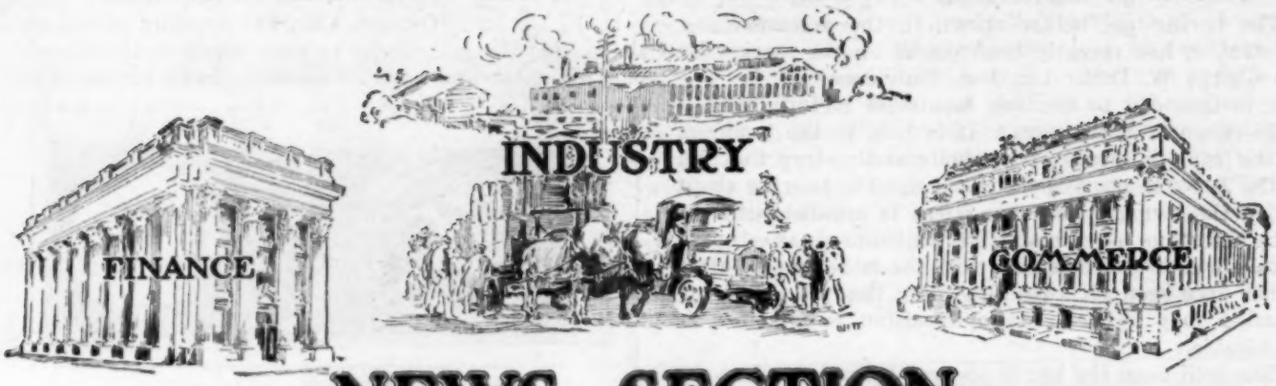
The Pittsburgh Stencil and Tool Co., 40 Water St., Pittsburgh, Pa., has recently placed on the market its "Super" steel stamp for use in stamping numerals or symbols in metal. The accompanying illustration shows one of the stamps made from 1-in. square stock and 4 in. in length, carrying a numeral ¾ in. high.

The stamps are made from a special quality of steel and heat-treated. The head is so tempered that it mushrooms and curls down until the pieces merely drop off under the blows, instead of splitting and flying. This feature insures safety from accidents due to flying particles of the head.

To illustrate the qualities of the stamp, the following statements of the maker are given: "In stamping cold

PITTSBURGH "SUPER" STEEL STAMP

sheets, the shanks were absolutely worn down while the stamp itself was still in good condition." "The stamp has shown remarkable durability when stamping hot steel in a mill." "On automobile-spring steel of 512 Brinell hardness, after an hour of continuous hammering, the shank was made ⅜ in. shorter, the stamp itself was still in fair condition, while the spring was dished out by the cutting action of the stamp."



NEWS SECTION

Tests of Toolbits

The Bureau of Standards, of the Department of Commerce, has been conducting a series of tests on toolbits. A number of toolbits of standard high-speed tool steel were heat-treated in various ways to determine the effect of these treatments on the cutting qualities of the metal. About fifty-five cutting tests were made, and while no new facts were brought to light, the data obtained were interesting and show that it is possible to obtain valuable results from tests made with such small samples. This work is being continued, and an effort will be made to study the time temperature relations in preheating and hardening on the cutting qualities of high-speed tool steels.

Exports of Industrial Machinery

Exports of American industrial machinery show an increase of something like 170 per cent in value in 1921 over 1913, according to the Industrial Machinery Division of the Department of Commerce in a special review of the machinery export situation in which statistics for the first eleven months of 1921 are used to estimate the year's trade.

The impression that our foreign trade has collapsed is not justified in so far as exports of machinery are concerned, says the report in pointing out that exports of such machinery for the first eleven months of 1921 were valued at $238,007,585, against $92,312,457 for all of 1913. While official figures for the calendar year 1921 are not yet available $250,000,000 is a conservative estimate of the total value of the trade during the year which has just closed, in the opinion of the division.

According to the Industrial Machinery Division an extensive statement covering foreign trade in industrial machinery in detail will be prepared and released shortly after the complete figures for 1921 are available.

Auto Service Men Dine

The Automotive Service Association held its third annual dinner-meeting in New York City on Jan. 13. The table was laid in the Automobile Dealers Club, 1895 Broadway.

The dinner was in the nature of an informal get-together, after which an open forum was held. Service problems and methods were discussed from various viewpoints. J. R. Pyle, secretary of the association, was in charge.

Metallography at Brooklyn Polytechnic Institute

A comprehensive course in metallography has been announced by the department of chemistry and chemical engineering of Polytechnic Institute, Brooklyn, N. Y.

The course covers a study of the microstructure of iron and steel and the fundamental physical chemical principles. In the laboratory, samples of steel and iron of varying carbon content are polished and etched by the student, examined by the microscope and photomicrographs made. The effect of varying heat-treatment is carefully studied. The student is also given opportunity for studying a collection of prepared specimens of wide variety on hand in the laboratory.

The laboratory possesses an adequate equipment of grinding and polishing wheels, microscopes, photomicrographic outfits, dark room, pyrometers, electric and gas furnaces and other accessories.

The course consists of fifteen lectures given on Friday evenings and fifteen two-hour laboratory exercises on Friday or Monday evenings commencing Feb. 3.

Further information as to this and other courses, as well as catalogs, may be obtained on application to the director of the evening department, Polytechnic Institute, 99 Livingston St., Brooklyn, N. Y.

Industrial Engineers at Detroit in April

The tentative program for the annual convention of the Society of Industrial Engineers has just been announced. The meetings will be held at the Hotel Statler, in Detroit, from the twenty-sixth to the twenty-eighth of April.

A varied program of technical sessions, luncheons and visits to nearby plants makes up the body of the convention. The speakers have been chosen from the most select fields of industrial engineering. Among the subjects to be discussed are: Industrial engineering as a service to managers, executives, sales and factory managers; production, finance and industrial relations, labor and the public.

Joseph W. Roe, president of the society, will open the convention on the first day. As the program is more fully arranged, further information will be furnished by the secretary, George C. Dent, whose office is at 387 S. La Salle St., Chicago.

Industrial Fair at Manila

A commercial carnival and industrial fair under the auspices of the Philippine Carnival Association will be held in Manila, Philippine Islands, Feb. 4 to 12. All the industrial and commercial phases of the Island's business will be exhibited in specially erected buildings. The slogan of the carnival will be "Boost Business." The auditorium with its many amusement attractions will be a feature of the nine-day celebration.

Several foreign business houses have arranged for a display of their wares, besides the many American firms who will be represented.

The association has two offices in the United States, one at 280 Broadway, New York City, and the other at 681 Market St., San Francisco, Cal.

Oriental Market for American Magazines

The Orient is a particularly attractive field for the development of the circulation of American magazines, which, except to regular subscribers, are now almost unknown, except in a few centers like Shanghai. English is being learned everywhere, and the illustrations are always interesting to an oriental, even when the text is not understood. There are no native publications of the same class. The English popular magazines can not compete in price, outward attractiveness, human interest, illustrations, or text, and other European magazines are barred by language. There is everywhere a great interest in American and things American.

It is suggested that a study be made by American magazines, advertising men, export associations, and manufacturers of the means for utilizing more effectively this powerful agency for the development of American interests abroad.—*Commerce Reports.*

Philadelphia Foundrymen Meet

The 313th meeting of the Philadelphia Foundrymen's Association was held in that city on Jan. 11.

Walter Wood, of R. D. Wood & Co., gave an interesting account of his recent travels in Europe. He told of prevailing conditions in London, Paris, Rome, Vienna and Warsaw. An illustrated lecture on "Sil-O-Cel" was presented by C. A. Frankenhoff of the Celite Products Co.

American Engineering Council Holds First Annual Meeting—Plans for Future Activities

Rounding out a year of improved organization, substantial accomplishment and strengthened purpose, the American Engineering Council of the Federated American Engineering Societies held its first annual meeting at the Cosmos Club, Washington, Jan. 5 and 6. Dean Mortimer E. Cooley of the University of Michigan, president of the Council, presided. Officers were chosen, the work of the past year reviewed and discussed, action taken on important matters of public and technical service, new financial arrangement put into effect, committees named, new policies sanctioned and old ones reshaped, and a broad and definite program outlined for the next twelve months. A leading event of the meeting was a dinner in honor of Herbert Hoover, who, addressing the members of the council and their guests at the University Club, praised the work of the Committee on Elimination of Waste in Industry as a great and lasting public service, pointed the way for new engineering effort in the public interest, and expressed renewed devotion to the ideals of the council. Resolutions of appreciation of the service of the new Secretary of Commerce were presented to Mr. Hoover.

The balloting for officers resulted in the re-election as vice-presidents of Dexter S. Kimball, dean of the college of engineering, Cornell University, and J. Parke Channing of New York. W. W. Varney of New York was again chosen treasurer; L. W. Wallace was re-elected executive secretary by unanimous action of the executive board.

The council made provision for a continuance of its national publicity work under the direction of James T. Grady, director of the department of public information of Columbia University, New York.

The executive board of the council for 1922 is made up as follows: H. E. Howe, Washington, American Institute of Chemical Engineers; Prof. C. F. Scott of Yale, L. B. Stilwell and Calvert Townley of New York, J. H. Finney of Washington, William McClellan of Philadelphia and L. F. Morehouse of New York, representing the American Institute of Electrical Engineers; J. Parke Channing and S. Dwight of New York, Charles H. MacDowall of Chicago and Philip N. Moore of St. Louis, the American Institute of Mining and Metallurgical Engineers; L. P. Alford of New York, E. S. Carman of Cleveland, Dean D. S. Kimball of Cornell, Prof. A. M. Greene of Troy, Dean Perley F. Walker of Kansas, W. S. Lee of New York, Dean M. E. Cooley of Michigan, American Society of Mechanical Engineers; Prof. Joseph W. Roe of New York Society of Industrial Engineers; Morris L. Cooke, Philadelphia, Taylor Society; W. E. Rolfe, Associated Engineering Societies of St. Louis, W. W. Varney, Baltimore.

During the coming year a study will be undertaken of the Water Power Act and its application, so that suggestions may be made as to its administration and amendments to the act itself suggested if it should be decided that the fundamental law can be improved.

Every resource of the federated societies is to be brought to bear immediately in an effort to secure legislative relief for the Patent Office; to secure an embargo on dyes, and to secure authorization for the appropriations to carry into effect the plant of the U. S. Geological Survey for the completion of the topographic map of the United States.

The principal accomplishments of the federated societies during 1921 were cited as follows:

Elimination of waste report.

The securing of employment for 1,221 engineers during the first eleven months of 1921.

Securing the publication of over five hundred articles pertaining to the activities of the society.

Legislative activities which involved active work, or at least a study of the Patent Office relief; topographic map of the United States; commissioned status for sanitary engineers of the United States Public Health Service; Department of Public Welfare; cyclical depressions; Federal road act; water-power act; Muscle Shoals project; reclassification and compensation of engineers in government service; tariff on petroleum; embargo on dyes; war minerals liberalization; Winslow refunding bill; Ladd metric system bill; forestry legislation; St. Lawrence waterway; Department of Public Works, and general executive reorganization.

Participation in such conferences as —Elimination of excess variety of paving brick; standardization of contracts and specifications in the construction industry; unemployment conference; census statistical conference; Board of Surveys and Maps.

Continued study of problems involved in the licensing of engineers and participation in hearings in a number of states.

Addresses before numerous engineering societies.

Stimulation of interest among engineers of foreign countries which has led to the formation of federations of engineering societies in six countries and paving the way for an international federation.

Study of continuous process industries.

Progress toward the more definite establishment in the public mind of the place and prominence of engineers in modern civilization.

Progress in developing a professional consciousness among engineers, giving them reason to take more pride in the fact that they are engineers.

Establishment in the minds of Federal legislative and executive officials that they now have a definite point of contact with engineers as a whole.

Unemployment Figures for December

Unemployment increased by 4.7 per cent during December, according to the telegraphic survey made by the U. S. Employment Service. The survey covered 1,428 firms located in the principal sixty-five industrial centers of the country. These concerns were employing 1,493,107 workers on Dec. 31.

Increased employment is shown in textiles, iron and steel, lumber, leather, paper and printing, and metals and metal products other than iron and steel. The decreases were mainly in the food industries, liquors and beverages, chemicals, stone, clay and glass products, tobacco manufacture, vehicles for land transportation and railroad repair shops.

Of the sixty-five cities covered by the survey, twenty-nine report employment increases during December over November, with percentages of increase, as follows: Philadelphia, 6 per cent; Milwaukee, 5.8; Dayton, 4.9; Los Angeles, 4.8; Toledo, 4.7; Paterson, 3.7; New Haven, 3.1; Albany-Schenectady, 2.9; Columbus, 2.5; Fall River, 2.4; Niagara Falls, 2.4; Reading, 2.3; Indianapolis, 1.9; Rochester, 1.8; Worcester, 1.7; Chattanooga, 1.6; New Orleans, 1.5; Lowell, 1.5; New York, 1.5; Lawrence, 1.4; Youngstown, 1.3; Manchester, N. H., 1.1; Cincinnati, 0.68; Bayonne, 0.6; Boston 0.54; Providence, 0.45; Yonkers, 0.37; Birmingham, 0.3; New Bedford, 0.26.

Thirty-six cities reported employment decreases in the following percentages: Detroit, 47.6 per cent; Omaha, 21.2; Peoria, 17.6; Johnstown, 17.3; Sioux City, 15.6; Seattle, 12; Syracuse, 11; Grand Rapids, 10.7; Memphis, 10.5; Baltimore, 10.5; Minneapolis, 9.6; Portland, 6.9; St. Paul, 6.6; Buffalo, 6.1; St. Louis, 6; San Francisco, 5.8; Atlanta, 5.7; Perth Amboy, 4.9; Camden, 4.7; Jersey City, 4.6; Cleveland, 3.8; Waterbury, 3.7; Richmond, 3; Chicago, 2.7; Passaic, 2.5; Pittsburgh, 2; Kansas City, 2; Kansas City, Kan., 1.6; Louisville, 1.4; Denver, 1; Newark, 0.98; Trenton, 0.87; Flint, 0.8; Brockton, 0.4; Bridgeport, 0.3; Springfield, Mass., 0.12.

Foreign News Notes

The Italian Parliament has just appropriated the amount of 200 million lire for the construction of new merchant vessels. Twenty-five ships costing about 200 million lire will be constructed. Orders will be placed in the very near future. All ships are to be built on Italian yards exclusively.

A Soviet steamer recently touched the port of Bremen where she took several locomotives and about 1,000 tons of agricultural machinery and implements on board.

The Krupps at Essen, after an interval of three years, are paying dividends again. Six per cent is paid on preferred and 4 per cent on common shares. Out of the net profits of 94 million marks, 40 millions will be used for rebuying shares to this amount which the company had sold in Holland for the Krupp family in order to enable them to pay the extraordinary state taxes. The capital stock of the company will be increased by another 250 million marks. Part of the new shares will be offered to the employees of the company.

A British Syndicate, the head of which is Robert William Dunsmiur, only heir of the late Lord Dunsmuir, ex-Prime Minister and Governor of British Columbia who owned large mining properties and railways in Canada, has been granted the largest concession ever agreed upon by the Peruvian government. The syndicate is to construct new railroad lines in Peru of a combined length of 3,000 kilometers, as well as expensive harbors in different parts of the country. The total expenditure for these undertakings is estimated at no less than £13,500,000. All material used in the construction of the railways, as well as all rolling stock, is to be imported from Great Britain, exclusively.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Nineteen hundred and twenty-one, with its disappointments, is fading into the past and men are becoming normally cheerful again. The old year is buried and like soldiers returning from a military funeral the business community is quickening its pace as it marches to the music of hope.

Fundamentally, the better feeling is due to the natural optimism of mankind. It is a blessed fact that as we look forward we are prone to forget the troubles that are behind, but there is also much that is affirmatively encouraging in our domestic situation. First and most important is the growing ease of money. On call it has loaned at 3 per cent and good commercial paper can now be sold at 4¾ per cent. In London the open market rate for short bills has fallen to 2¾ per cent.

The Federal Reserve Banks at Dallas and Minneapolis have reduced their rediscount rates to 5 per cent and it is generally expected that the New York, Boston and Cleveland Reserve Banks will soon go to the 4 per cent rate. The weekly statement of the Federal Reserve System shows a sensational rise in the reserve rate to 74.7 per cent, 3.6 per cent above last week and one of the largest increases ever recorded. It also shows a gain of $20,000,000 in the gold held, which now exceeds by $600,000,000 the $2,300,000,000 of Federal Reserve Notes outstanding.

Bond Market Steady

The first effect of the decline in interest rates has been an advance in bonds. The Liberty and Victory issues are selling at practically the highest prices on record since just after they were brought out and all good investment securities are appreciably stronger.

It is, however, still possible to buy many good bonds and preferred stocks on a basis which yields more than 6 per cent and the gradual absorption of such issues at advancing prices is to be expected. As yet there is but little speculative demand for the low priced railway and industrial stocks that pay no dividends. The theory is that the ease of money reflects a degree of commercial inertia that is incompatible with a bull stock market. It is, however, certain that people will borrow and buy when credit is cheap and easily obtainable.

Therefore it seems entirely probable that a general and a pronounced revival in business will be seen just as soon as some plan for the financial reorganization of Europe is made effective. This is the big "if" and it has become somewhat bigger with the abrupt adjournment of the Cannes conference following Briand's equally abrupt resignation as Premier of France. Even assuming that the Cannes conference will be resumed, which is doubtful, the accession of ex-President Poincare to the Premiership is likely to increase the difficulty of reaching an agreement as to German reparations at the Genoa economic conference.

However, the mere calling of the conference indicates a willingness to co-operate and to forget racial and political differences, in which France is not likely to prove backward, and while as in the case of Disarmament Congress at Washington now closing we shall probably be disappointed at the things actually accomplished there is cause for satisfaction in the spirit of accomodation, compromise and co-operation that find expression in these gatherings.

Optimism in Industry

Meantime it is with gratitude that Ireland's acceptance of the peace treaty is noted as we turn again to our own affairs and read an advertisement of the New York Central Railroad announcing that on Monday morning, Jan. 9, the number of through passengers arriving at the Grand Central Station on limited trains was the largest ever recorded. To accomodate them the eastbound "Twentieth Century" was run in four sections, the "Fifth Avenue Special" in three sections, the "Wolverine" in two sections, the "Detroiter" in five sections, and the "Beaver" in two sections.

The influx was of course directly due to the automobile show, but it is nevertheless important as indicating the optimism felt in what has come to be one off our most important industries. Of the results of the show itself it is too early to speak. The attendance has been large and the price reductions announced have attracted much attention but the effect upon sales will not be known for some time.

Most of the commodity markets have been static but some of them call for special comment. Mr. Hoover's prediction of an advance in sugar has attracted wide attention and has been followed by a very slight gain in the price of raw sugar and contracts for its future delivery. The indications favor a further improvement, for sugar seems to be in much the same position as was cotton eighteen months ago. The present supply is excessive but there is every prospect that production will be curtailed.

Coffee is steady and the statistical position appears to gain in strength as it develops. The Brazilian government is supposed to control the bulk of the supply now held in the United States.

The undertone in cotton is hardly as confident as it was because the large "carry over" is being again exploited by the bears. It is, however, well to remember that those who own the surplus whatever it may be are now able to hold it and make it more valuable by planting less next year. This fact and a mild winter which favors the spread of the boll weevil are bullish factors of the first importance. It is, however, to be admitted that some who are usually accurate in their views expect an increased rather than a decreased planting next year.

Wool continues surprisingly firm and the prices paid at recent auction sales here and abroad are distinctly higher. Statistically the supply seems ample but practically it is so well controlled that it is not a depressing influence. Both woolen and cotton textiles are in good but not extraordinary demand and the trade seems stabilized.

In iron and steel the gradual resumption of ore mining on the Minnesota ranges is significant of the belief that the latent but unsatisfied demand for steel will be manifest before 1922 is very old, and the Iron Trade Review estimates that 100 per cent more ore will be mined this year than in 1921. Copper is firm, with nearly everybody in the trade looking for slightly higher prices. Despite denials from the companies concerned, persons who ought to know state that a merger of porphyry producers is being negotiated, an important addition to the long list of combinations which are being planned to reduce the wasteful cost of competition in an era when wasteful costs cannot be passed on to consumers.

Another cut has been made in Pennsylvania crude oil and gasoline has been reduced in several states. Mid-Continent producers are reported to have a "gentlemen's agreement" to keep up prices, but crude production is at the highest in our history, the Mexia field is turning out 175,000 barrels daily, and it is not likely that the producers can long resist the pressure of supply. Grains are less steady as they meet increasing competition from foreign crops in the export market. A campaign to reduce corn acreage is under way and will result in considerable curtailment if the corn belt farmers contrast the prolonged depression of their markets with the substantial recovery in cotton which followed the Southern growers' control of the production.

Waiting for Lower Rates

Building in December was double that of last year and even exceeded November's total. Railroad net earnings tell a less satisfactory story, dropping to 3.8 per cent on their property valuation in November from 5.4 per cent in October. Traffic is light and will continue so until buyers know definitely whether they will profit by lower freight rates if they postpone their purchasing. More than anything else this uncertainty as to one of the principal elements in calculating costs is delaying the extension of trade which may justly be expected to follow declining money rates and the revival of confidence with which 1922 was generally greeted.

The New York firm of Childs & Joseph doing a large export business with Central and South America, is in the hands of a creditors' committee. Liabilities are estimated at $7,000,000. It is another "hangover" from last year.

Automotive Engineers Hold Nineteenth Annual Meeting

S. A. E. Meets in New York During Automobile Show Week—Large Number of New and Revised Standards Acted Upon—Good Technical Papers Presented

As usual, the Society of Automotive Engineers held its annual meeting at the Engineering Societies Building in New York City during the week of the automobile show. Registration began on Tuesday morning, Jan. 10 and the rest of the day was devoted to the customary meeting of the standards committee. Several new standards were presented, but in the main more attention was given to the revision of adopted standards and practices and the reconciliation of S.A.E. and A.S.T.M. specifications which covered similar materials with only slight differences in wording or figures. With two exceptions the standards were approved and advanced to the stage of letter ballot by the voting members.

The Tuesday evening session was turned over to aviation and was concentrated upon the consideration of a paper on air-cooled engines by Charles L. Lawrence. Mr. Lawrence traced the development of air-cooled airplane engines and laid particular stress on the various cylinder constructions experimented with to obtain satisfactory cooling.

The Wednesday morning program was devoted to an outline of the various activities of the society. President Bucroft opened the meeting by telling of the accomplishments of the organization which he said were out of all proportion to its age. He then introduced aeronautic vice-president H. M. Crane, who made an informal report on the work of the new research department in the absence of Dr. Dickinson, the head of the department, because of illness. Mr. Crane took advantage of Dr. Dickinson's absence to say that the best job done by the research committee was the securing of Dr. Dickinson's services.

At the same time Mr. Crane read a report on the developments in aviation during 1921, laying stress on the commercial achievements and pointing out the great handicap of inadequate terminal facilities.

Vice-president Harry L. Horning read a paper on the international affiliations of engineers calling attention to the world economic problems crying for solution by the engineers of the world.

B. B. Bachman, passenger car vice-president, told of the developments in the passenger car field, giving it as his opinion that all the major problems in this division could be classifield as fuel problems or highway problems. He mentioned the problem of building roads that would last as long as the bonds issued to finance them, and also pointed out the new and serious problem of traffic in metropolitan districts, which he considered as distinctly a highway problem.

The report for the tractor division was read by vice-president E. A. Johnston, who told of the serious setback the industry had suffered because of the hardships of the farmers. Vice-presidents Menges, of the stationary engine division, and Van Blerck of the marine engineering being absent, their reports were not read, the meeting passing on to the report of the treasurer and the reports of the standing committee. The report of the tellers of election followed and the slate chosen at the summer meeting was declared elected. The retiring president then made his valedictory address in which he commented on the economic opportunities and responsibilities of the engineer and more particularly of the automotive engineer.

The new president, B. B. Bachman, of Philadelphia, was introduced and made a very brief address before the meeting adjourned.

Simultaneous sessions were held in the afternoon on lubrication, motor bus transportation and body building and finishing. The high point of the meeting, from a technical point of view, was reached at the research session on Thursday morning where but one paper was presented. It was prepared and read by Harry Ricardo, the famous British automotive engineer who made the trip to the United States as the guest of the society. Mr. Ricardo's subject was "Some Recent Investigations and Deductions," and it was received with the greatest interest. It evoked considerable discussion. Unfortunately, any account of the subject covered is entirely beyond the scope of this story.

Simultaneous sessions were held in the afternoon on the general subjects of engines and fuels, and materials. At the engine and fuel session papers were read by O. C. Berry and C. S. Kegerreis, on "Manifold Vaporization and Exhaust Gas Temperatures," by Thomas Midgley, Jr., and T. A. Boyd, on "Methods of Measuring Detonation in Engines"; and by Thomas Midgley, Jr. and W. K. Gilkey, on "Spectroscopic Investigation of Internal Combustion Engines."

The materials session was of special interest and was enlivened by considerable discussion. C. N. Dawe, metallurgical engineer of the Studebaker Corporation gave the result of many tests on chrome-molybdenum steel for various parts. About 400 tension pieces 2 in. and smaller were tested. J. H. Nelson of the Wyman-Gordon Company felt that these tests were not conclusive and that a higher carbon and chromium content in chrome-nickel and chrome-vanadium would give equally good results.

Mr. Dawe concludes that chrome-nickel steel apparently still holds the first place among commercial steels for case-hardening of important parts, but it is the opinion that nickel-molybdenum steel will be a serious contender. At present they have a heat of approximately 100,000 lb. of nickel-molybdenum steel of the following analysis: Carbon 0.130, manganese 0.380, sulphur 0.022, phosphorus 0.020, nickel 1.580 and molybdenum 0.200 This material is being made into gears, knuckle-pins and the like. This steel should prove a serious contender with chrome-nickel steel for case-hardening purposes, because of its ability, in the hot-rolled condition, to harden in oil after carbonizing. This statement may not be wholly clear to some, but it is a fact that a piece of hot-rolled steel of a given composition after carbonizing will not harden in oil to the degree that a piece of the same composition will if first subjected to forging.

To summarize this portion of the subject briefly, our observations lead us to believe that, for carbonizing purposes, chrome-molybdenum steels should prove entirely satisfactory for parts in which hardness alone is the chief factor, but should be considered carefully before being used for important parts in which combined toughness and hardness are requisite, such as gears, steering-knuckle pins and the like.

The results thus far obtained with nickel-molybdenum steel are very satisfactory in every way when compared with chrome-nickel steel, with the added advantage of the greater hardness that can be obtained from an alloy-steel of the former type.

In a paper on "Continuous Die Rolling," G. R. Norton, works manager of Witherow Steel Co., showed what was being done along this line and compared the results with the usual method of upsetting to obtain a larger cross-section, as in automobile drive shafts. Photo micrographs of etched samples showed the even flow of metal and the freedom from distortion in the rolled section. These photographs were particularly interesting.

The drop forging practice paper presented by J. H. Nelson, of Wyman-Gordon Co., discussed the subject from the standpoint of the materials used and strongly advocated a more rigid inspection and testing of raw products to determine their fitness for use in making automatic forgings.

Seven specific possibilities of actual difference between drop-forgings that are apparently identical are stated, the requirements of the inspection of raw stock are commented upon, and the heat-treatment and testing of finished forgings are considered at some length.

Tabular data of the chemical analyses and physical properties of 107 different heats of carbon-steel used recently were presented and showed a variation in drawing temperatures of 140 deg. F. in steels of practically the same chemical composition to meet the same physical-property specification, based on more than 1,000 tests on this grade of steel taken from production stock. The concluding summary has five specific divisions.

(1) Steels of the same grade and of the same chemical composition do not respond in the same way to heat-treatment. (2) To heat-treat with minimum loss, only steels from the same melt should be included in a furnace charge. (3) Stock subjected to heat-treatment should be carefully segregated into piles of the same melt; it should be kept segregated throughout the entire process of fabrication to produce satisfactory forgings of uniform quality. (4) Tensile and hardness tests should be required on all heat-treated forgings to check the thoroughness with which the various heat-treatment operations were performed. (5) At least one hardness test should be made on all heat-treated forgings to insure that all have responded to the heat-treatment operations in the same manner.

The paper was discussed at length by both steel makers and users.

The last paper of the session was

by Prof. Enrique Touceda, on "Pertinent Facts Concerning Malleable-iron Castings."

A passenger car session was held on Friday morning at which the speakers were J. E. Schipper on "Passenger Car Brakes," S. Von Ammon on "Developing a Method for Testing Brake-Lining," and by August Trowbridge on "Photographic Recording of Engine Data."

The carnival took place on Wednesday evening and was a grand success. Entertainment to suit everybody no matter what his tastes, was supplied and apparently met with the entire approval of the members and their guests.

At the annual dinner on Thursday evening nearly a thousand diners met at the Hotel Astor to enjoy the food, regret the drought and listen to the wit of the toastmaster and the wisdom of the speeches. Charles F. Kettering was toastmaster and as usual mixed some direct shots of hard common sense with his scattering fire of witticisms and stories. Appropriate remarks were made by the retiring and newly-elected presidents. The speaker of the evening, Arthur R. Marsh, editor of *Economic World*, painted a picture of the general economic situation which was very realistic. He laid extra emphasis on the fact that in the long run the only thing that can be exchanged for goods is goods. This being true, we can expect little trade with Europe until her people are able to produce goods which they can exchange for ours. Purchasing power at home depends largely on the farmer and the success of his crops. If, as is now the case, he is asked to pay a price measured in terms of his product for the articles he wants, that is out of all proportion to the basis established before the war by decades of adjustment, then business must inevitably be slowed down. Measured in bushels of corn he now pays five times as much for shoes or clothing as he did in 1913. No wonder he does not buy and we have unemployment in the metropolitan districts.

Mr. Marsh concluded by calling attention to a very definite, if not a very prominent, improvement in the output and willingness to work of the European producers, and said that as this tendency grew, our credit and exchange difficulties would diminish and eventually prosperity would return.

Accessory Manufacturers Elect Officers

The Motor and Accessory Manufacturers' Association held a dinner in the Hotel Commodore, New York City, on Wednesday evening, Jan. 11. A large number of the members, who were in attendance at the Automobile Show, were present at the dinner.

On Thursday morning the members met in the associations rooms on 42d St., and re-elected three members on the board of directors, whose terms had expired. E. P. Hammond, C. E. Thompson and J. M. McComb were the men chosen.

Officers of the association are: E. H. Broadwell, president; W. O. Rutherford, first vice-president; A. W. Copland, second vice-president; H. L. Horning, third vice-president; L. M. Wainwright, treasurer; G. B. Griffin, secretary; N. L. Heminway, general manager.

Auto Show Brings Out Ninety-two Exhibits

Those who recall the early automobile shows in Madison Square Garden cannot fail to be impressed by the tremendous strides that have been made. Perhaps the fact that in the early shows there was a track on which the various makers could demonstrate that the cars would actually run, indicates the state of the business at that time as well as anything. Then too, we had not appreciated the value of safety and we incurred fire hazards which no one would dream of today.

There were ninety-two makes of cars exhibited at the 1922 show, a few of them new, but for the most part those with well known names. Launching new cars is a very different proposition than in former years. The competition of the year seems to be among the builders of small or medium six-cylinder cars and the growth of the closed body is very noticeable. Two makes, the Dort and Essex, show a low priced closed body much nearer the price of open bodies than anything heretofore built.

The following facts and figures, concerning the automobile industry, form a basis for probable business this year:

Automobiles registered in U. S. (approximately)	10,000,000
Motor cars	9,000,000
Motor trucks	1,000,000
Cars and trucks owned by farmers	3,000,000
Motor cars	2,850,000
Motor trucks	150,000
Farm products hauled by motor transport (tons)	134,400,000
Schools using motor bus transportation for children	12,000
Motor buses in operation	20,000
Organized public motor express lines	1,500
Cities having organized motor bus lines	600
Passengers carried annually by motor car	6,000,000,000
Freight hauled annually by motor truck (tons)	1,200,000,000
PRODUCTION IN 1921	
Cars and trucks	1,680,000
Decrease from 1920 production	24%
Cars	1,535,000
Trucks	145,000
Wholesale value of cars and trucks produced	$1,222,350,000
Decrease from 1920 wholesale value	45%
Wholesale value of motor cars produced	$1,088,100,000
Wholesale value of motor trucks produced	$134,250,000
Average wholesale price motor car 1921	$702
Average wholesale price motor car 1920	$897
Average wholesale price motor truck 1921	$968
Average wholesale price motor truck 1920	$1,273
Motor car factories in U. S.	105
Motor truck factories in U. S.	140
States in which factories are located	32
Employees engaged in car and truck manufacture	256,000
EXPORTS	
Value of motor vehicles and parts exported, including engines and tires	$102,945,610
Number of motor cars exported	$30,639
Value of motor cars exported	$33,712,208
Number of motor trucks exported	7,748
Value of motor trucks exported	11,457,616
Number of countries to which automobiles were exported during year	114
DEALERS AND GARAGES IN U. S.	
Passenger car dealers	38,216
Motor truck dealers	24,488
Garages	59,093
Repair shops	55,521

While only two air-cooled cars were in the show itself, another was shown at the Hotel Commodore and a fourth at a local showroom. The Stanley steamer was alone in its class in the show, but had a rival at the Commodore.

One car, the Bournonville, was equipped with a rotary valve motor, this type of valve proving periodically attractive to designers but never as yet surviving the test of time. A section of the Franklin case-hardened crankshaft, fractured purposely to show the depth of the case and the soft center, attracted attention. There seemed to be fewer novelties among the accessories, although the problem of preventing theft has received wide attention.

Machine tools and supplies were well represented; Heald had a new piston ring grinding machine; Landis a cylinder grinding machine; Norton a crankshaft grinding machine; Van Norman, piston grinding machines; South Bend Lathe Works, several lathes and attachments, and the Vibration Specialty Co., a new balancing machine. Among other exhibitors in this section were the American Non-Ferros Metal Corporation, Wallace Barnes Co., Bassick Manufacturing, Champion Pneumatic Machinery Co., Clark Equipment Co., Eclipse Machine Co., Millers Falls Co., Morse Chain Co., Veeder Manufacturing Co., and Wyman-Gordon Co.

Fords To Bid for Lincoln Plant

The receivership for the Lincoln Motor Co., Detroit, Mich., has caused much comment, so that the plan of Henry and Edsel Ford to bid for the plant at the auction of Feb. 4 is of special interest to all in the automotive field. Whether the Ford interests really want the Lincoln plant may be open to question, although all who know of the Ford faculty for producing automobiles at low cost realize that they would make a distinct mark in the high-grade field. At any rate they will force others to pay somewhere near what the plant is worth instead of allowing it to be bought in far below its value. As the court placed a low value of $8,000,000, the bids must at least equal this. Rumor has it that Ford will bid as high as $11,000,000 if necessary.

The old company will be dissolved and the new Lincoln Motor Corporation formed, retaining the Lelands in the management. Every effort will be made to work out a plan to reimburse those who had actually invested cash in the company. The sale will be awaited with interest.

Move To Continue Screw Thread Commission

In recommending to the House of Representatives that it extend the term of the National Screw Thread Commission for a period of five years from March 21, 1922, the Committee on Coinage, Weights and Measures states that "there would seem to be no good reason why the commission should not be authorized to continue its work for the period suggested. There is no division of opinion in the committee."

Representative Vestal, of Indiana, chairman of the committee, in his report to the House, states that the commission "can perform a very important additional work by establishing standards for certain special screw threads—for instance, such as are used in pipes and couplings. Another important work proposed for the commission is that of establishing suitable standards of sizes and shapes for bolt heads and also for standardizing the gages of wire and rods used in the manufacture of screws."

German Machine Tool Industry at the End of 1921

By OUR BERLIN CORRESPONDENT

The year just completed has been for the German machine building industry an eventful time, unparalleled in its history, with the exeeption perhaps of the year 1919. Like in 1919, business moved in a steep line and jumped suddenly from deep depression to a period of activity which, if it is not a boom, bears a close resemblance to one. The shifting of the scenes from utter dullness to business of great briskness has been so sudden that the industry has been taken entirely unawares, plunging it into considerable confusion. The effects are already becoming noticeable and are threatening to cut short the life of the present boom before it has had time to come into full swing. Manufacturers were reluctant to lay in stock during the time of business depression, and the iron mills reduced their output. The inevitable result was that raw material became scarce when business revived, and the production was unable to cope with the rush of the demand.

It appears that very little has been done since the war by the iron works to follow the fluctuations of the market. The small reserves of material were soon exhausted. The output of raw material being entirely unequal to the present consumption, conditions are getting worse every day, and have already reached such a state of stringency that a number of shops have been forced to reduce working time. As a consequence, the re-establishment of maximum prices and the rationing of raw material are under contemplation. The serious aspect which the coal situation is taking at the same time, puts a limit to the capacity of the iron works, and leaves no hope that conditions can be improved no matter how severe the pressure grows. This is not the only item which makes the present boom appear to be short-lived. In fact, people in a position to view the whole situation have frequently warned the country against illusions in this respect, saying that the crest of the wave can break any day, and declaring the present boom to be a *valuta* boom solely, and no real one. A very serious argument put forward by the skeptics with regard to the duration of the boom is the fact that it is based only in a small degree upon the export market and chiefly upon the domestic market, and that the reigning spirit of the latter is not a serious demand but mainly speculation. As a matter of fact the ratio between the mark and the dollar has become the ruling factor in Germany's economical life. Business expands and contracts almost in the same proportion and nearly as quickly as this ratio changes. Not better can the instability of the present boom and the unsoundness of the whole business situation be characterized than by the fact that the depreciation of the money has become the only stimulant of business.

A gigantic battle has been waged, under the surface, during the last months between the government and the exporting industries for the proceeds of exports, carrying in its train all the various issues and questions which the industries want to be settled in their favor before listening to the claims of the government. It is characteristic of the relation of strength prevailing between both parties that the government has not attempted to enforce those claims. On the other hand, it was unable to accede to the counter-claims of the industry, which fill a whole list of demands like the private ownersship of railroads, revised taxation policy, and the abandonment of socialization schemes. At present, industry can be said to occupy a certain control over the government. Not content with this position, it strives to assume complete control by making use of the upper hand, which it no doubt has, as the sole supplier of the gold money required by the government. At present a truce has been reached between the two parties, in view of the exceedingly serious financial situation of the country, but there can be no doubt the strife will be resumed as soon as conditions permit it. As an effect of this truce, the industrial organizations which appear to be pulled more or less by the same strings, have come to the rescue of the government by deciding to deliver to the government part of the export proceeds. This was lately decided upon in an extraordinary meeting of the German machine builders, which proclaimed the willingness of this industry to surrender 25 per cent of the values of its export returns to the government. For the present this must be considered the limit of the help the industry is lending the government.

Although the buying wave came with a rush right after the breakdown of the German money market, it did not sweep over all parts of the industry with equal force. A marked differentiation could be noted in various branches of industry. The rise of the demand was not general but specific, with regard to quality and types of goods. This is especially true of the machine building industry. The machine tool building industry, for instance, was late to profit from the revival of business. As late as October the majority of the works complained of insufficient business, although such complaints should not be taken too literally, as the machine tool people still remember too vividly the bonanza times of the war years and the boom of 1919, and, having increased the capacity of their works, they are somewhat spoiled. But it is a fact that until September the tools in stock gave little sign of diminishing, nor was there any material change noticeable with regard to delivery times quoted. This change took place during October, and chiefly in November. In the course of these two months quotations from stock have almost ceased, and delivery times, which varied from four to twelve weeks, have been considerably extended. Several of the leading firms have in fact sold out their production until May and June of 1922. The official labor statistics provide a striking illustration of the sudden change which took place. While in August only 45 per cent of the workmen employed in the machine building industry were working full shifts, this percentage was 99.1 per cent at the beginning of December.

Prices have risen quickly in proportion to the increased demand. The Association of German Machine Tool Builders has recently fixed as a minimum a sale price thirty times the pre-war price, or 30 m. per kilogram, the pre-war price averaging 1 m per kilogram. The price policy of the German machine building industry, including the machine tool industry, has recently been laid down at an extraordinary meeting of the Association of German Machine Builders, by Dr. Doehne, president of the Hartmann Machine Building Works in Chemnity, one of the largest German machine tool building concerns. The principle of this policy, Dr. Doehne says, is to base the domestic prices upon the actual manufacturing cost, and to keep the latter as low down as possible. For exports, the price is to be adjusted according to foreign competition, quite independent of domestic prices. It will, he says, be impossible to carry this out strictly, as the "hole in the West" (meaning the occupied territory) has not yet been closed effectively, and as frontier conditions in the East are by no means settled. The foreign competition aiming at ousting German industry from export markets has further to be taken into consideration. Dr. Doehne believes that in certain "high exchange" countries no more than the German pre-war price in gold can be obtained, while in others there is a wider margin. With regard to countries of "low exchange," it has been decided to sell at prices lower than foreign prices, but in every case higher than domestic prices, providing that guarantees are given that such machines will not find their way into countries of high exchange. If the German exchange improves it will make the manufacturer a loser, and for this reason the State Bank, it is declared, will have to arrange to guarantee against such losses, and a large part of the purchase price will have to be paid in advance.

In conjunction with the prices of new machinery, a general rise of prices took place also on the second-hand market. This rise has been further stimulated by the recent considerable increase of scrap prices. For machine tools little better than scrap, prices from 6 to 8 m per kilogram are paid, and in the case of still serviceable tools 15 m and even 20 m per kilogram.

It will be remembered that the German industry has during the last twelve months or more accumulated enormous sums by way of increase of capital, which was not in all cases due to actual needs. These investments, in which a large part of the population participated, as the fever of speculation has swept the whole country, amounted in the average to two billion marks per month. In the first ten months of

1921 over three billion marks face value were invested in new stock companies; eleven billion marks in increased capital; and nearly five billion marks in preferred capital. The total is, however, much higher, as all these sums have been issued considerably above par. In October alone eighteen new stock companies have been formed in the machine building industry, and forty-seven existing companies have raised their capital by three hundred and fourteen million marks. It was somewhat of a surprise that these huge sums did not find an outlet on the market sooner; the explanation is that they were kept back in the expectation of lower prices. When the reverse took place, and depreciation of the currency carried prices upward and the capital reserves were turned loose on the market.

The chief markets of machine tool exports are Belgium, France, Holland, Austria, Czeko-Slovakia and South America. Next to these are Switzerland, Spain and Italy, while France bought from Germany over 6,000 tons of machine tools monthly, Belgium even more, Great Britain took an average of 1,000 tons per month.

In view of the new reparations question, every rumor has an immediate effect on the money market, and through the latter on the industrial market. It is difficult to get a clear view of developments, even of the near future. The fact that the industrial organizations are shaping their policy to a low exchange of the mark indicates that those circles which, in cooperation with the banking institutions, have the money market well under control, believe in a prolonged duration of the present money depreciation. In fact it may be said that the whole of German industry, with the enormous following it has in its millions of stockholders, is viewing a possible improvement of the mark, as the result of revised reparations duties, with decided disfavor. German manufacturers have so far succeeded in keeping the workmen quiet by giving them a part, but never the whole, of their increased profits, by way of higher wages. At the present time wages paid in the machine tool shops are approximately 100 per cent higher than they were a year ago.

Approximately, the wages of hand workers have now risen to twenty times the pre-war standard, and the remuneration of clerical workers to from ten to fifteen times. It is true that in Germany the purchasing power of the mark is considerably higher than in foreign countries, but the ratio between pre-war and present wages is still in disfavor of the working classes. If a reverse movement of the exchange sets in, it will hardly be possible to screw the wages down at once. The real difficulty will commence when wages are forced to follow the retrograde movement of the exchange.

Nothing, or very little, has been done in Germany since the outbreak of the war with regard to higher economy of production. The work then in progress, following the lead of the United States, has been interrupted by the war and has never been resumed. A severe awakening to this fact has recently been caused by Director Hugo, one of the leading men in German industry, who has publicly stated that according to the testimony of German engineers who recently visited the United States, German manufacturing methods have fallen far behind those of America. In the case of a decided improvement of the mark, he declared, if only to ten or fifteen times below par value, German industry has no chance to compete against American industry. A similar but more explicit statement, headed "The Downfall of German Industrial Science," was prepared by one of the directors of the A. E. G. Electric Co., and submitted to the government. This statement has never been made public, but it is known that it dealt rather sharply with the indolence and assuredness of German engineers with regard to their methods of production. Eminent economists argue that the prevailing laxity in the shops is a consequence of a superabundance of profits, and that nothing short of the force of necessity, even culminating in a severe crisis, can again put the industry abreast of times.

As the German industry is unable to cope with different exchange conditions, and its present activity is solely based on the currency depreciation, and for this reason is dependent on the situation of the money market, the outlook for the coming year is a matter of the merest speculation. The only solid foundation which offers itself to the outlook is the agreement reached between Germany and France with regard to paying the reparations in goods. This promises to keep industry employed to a certain degree, together with the possibilities which appear to arise with regard to the rebuilding of Russia. As far as the home market is concerned, there is little illusion as to the probability of the present boom collapsing as quickly as it sprang up.

Business Items

The Black & Decker Manufacturing Co., builder of portable electric tools, of Baltimore, Md., announces that effective Jan. 3, it will make a freight allowance on shipments of 100 lb. or over to points in the United States and Canada. This will make it possible for all jobbers to sell Black & Decker goods in the United States and Canada without adding anything to the price to cover freight.

The Earl J. Bullard Manufacturing Co., with main offices at 219-220 Washington Bldg., Madison, Wis., has been organized and incorporated to manufacture and sell mechanical accessories, machine tools and appliances. E. J. Bullard, president of the new company, was recently granted a patent on a new piston ring, which the company will start manufacturing at once.

The Circle Supply and Machinery Co., a new wholesale establishment dealing in automobiles and machinery opened on Jan. 1 at 335 Decatur St. New Orleans, La. Motley Lewis, for the past ten years treasurer of the A. M. Lockett Co., dealers in machinery in that city, is president of the new concern; A. O. Levert, a large sugar planter of Levert, La., is vice-president, and W. S. Austin is consulting engineer.

Salesmen for the Black and Decker Manufacturing Co., Baltimore, Md., recently ended a sales conference held at the main office of the plant and which continued for a week. In addition to sessions at which business was discussed there also was a program of amusement. About fifty managers and salesmen from all sections of the United States and Canada attended.

It has been definitely announced that the Great Southern Steel Corporation, incorporated a few weeks ago with $105,000,000 capital under the Delaware laws, will shortly start the development of its coal and iron ore properties in the Alabama district, and begin immediate construction of a $500,000 steel plant near Birmingham. Permission to operate in Alabama was obtained a few days ago. During the past several months the corporation has acquired approximately 100,000 acres of coal and ore lands in Alabama.

The Lackawana Bridge Works Co. has purchased the plant and equipment of the Ferguson Steel and Iron Corporation at Buffalo, N. Y. The Lackawana Bridge Works Co., is a subsidiary of the Lackawana Steel Co., with a plant at Buffalo. This announcement was made by R. H. Kellog, secretary of the two companies.

B. Freidus & Co., of Boston, Mass., has opened offices at 1303 Columbus Ave., Boston. The company deals in new and used machinery and electrical apparatus.

The plant of the Davis-Price Foundry Machine Co., at New Cumberland, Ohio, has been sold to the Resistant Alloy Steel Castings Co., and will be opened this month. H. S. Ginger is superintendent of the factory.

The Canton Forge and Axle Co., has been incorporated at Canton, Ohio. Organization has been completed with F. C. Moore, president; H. C. Holloway, secretary; T. F. Dupuy, general manager. F. A. Poor, of Chicago, is chairman of the board of directors. The company will occupy the old plant of the Standard Parts Co., which it recently purchased.

P. & F. Corbin Co., of New Britain, Conn., has purchased from the New Britain Machine Co., the building in that city which was erected by the U. S. Government during the war for the manufacture of gun carriages. The plant will be equipped to manufacture hardware.

The Hart & Hutchinson Co., New Britain, Conn., has sold its land and buildings to the Hart & Cooley Co., but will continue to occupy the premises on a rental basis.

The Exeter Machine Works, Inc., of West Pittston, Pa., has appointed the Allen Engineering Co., of Boston, Mass., as its sales agent in the Boston district. The Exeter company manufactures a line of hoisting and structural machinery, cranes and mill equipment.

The Reed-Prentice Co., and associate companies the Becker Milling Machine Co., and the Whitcomb-Blaisdell Machine Tool Co., announce the removal of their New York office under the direction of P. K. Dayton, from the Grand Central Palace to Room 536, Singer Building, 149 Broadway.

The W. S. Rockwell Co., 50 Church St., New York City, has appointed Gibbons Bros., Ltd., Dudley, Worcester, England, as its sole agent in the British Isles.

The McCabe & Sheeran Machinery Corporation has been organized in New York City with offices at 149 Broadway. Mr. McCabe was formerly vice-president and manager of the McCabe Lathe and Machinery Corporation; Mr. Sheeran was treasurer and sales manager of the same company.

Salesmen of the Oliver Machinery Co., Grand Rapids, Mich., held a two-day convention at the home plant on Jan. 5 and 6. The time was spent in studying and analyzing the selling points of the latest types of machines.

W. H. Smith & Sons Co., planing mill operator, is rebuilding its plant at Johnson, Pa., which was recently destroyed by fire. New machinery in the form of mortising machines, bandsaws, planers, belt sanders, lathes and grinding machines will be installed.

Berggreen & McConnell, industrial engineers, has been organized by Paul H. Berggreen and Henry I. McConnell. The company has offices in the Oliver Bldg., Pittsburgh, Pa., and will specialize in valuation and examination of industrial plants and engineering enterprises.

Personals

O. D. WHARTON has resigned as vice-president and general sales manager of the Crucible Steel Co. of America.

O. M. RAU, formerly consulting engineer with the Philadelphia Rapid Transit Co., has become associated with the Hardinge Company, Inc., of New York City. He will specialize in the building of Quigley pulverized fuel systems.

WARREN D. BLATZ has been made general sales manager of the entire plants of the Bridgeport Brass Co., manufacturer of brass goods, etc., Bridgeport, Conn.

W. O. RENKIN has become associated with the Hardinge Company, Inc., of New York City. He will be managing engineer of the Quigley pulverized fuel department.

E. A. SHRINER has been appointed manager of the Motch & Merryweather Co. branch office in the First National Bank Bldg., Cincinnati, Ohio.

ROY MCNAMARA, road engineer and automotive expert, has joined the staff of the Rickenbacker Motor Co., as experimental engineer. Mr. McNamara was formerly engineer with the Maxwell-Chalmers Co.

CLAUDE SAUREDDE, designing engineer, has joined the staff of the Maxwell-Chalmers Co., of Detroit, Mich.

A. S. FETTERMAN has resigned as manager of the Averill Machinery Co., Spokane, Wash. He will be succeeded by E. W. Jones. Mr. Fetterman will become head of the Spokane Manufacturing Co.

JAMES L. BRIERTON, who has been in charge of all Southern properties of the Central Iron and Coal Co., with headquarters at Holt, Ala., has been named vice-president of the company. He will remain in charge of Southern operations. ROBERT A. ALLISON, who for many years has been treasurer of the company, has been named assistant manager of the southern properties and will also have headquarters at Holt. The company has extensive interests in the Alabama district, including a blast furnace and pipe shops at Holt.

C. W. HART, president and one of the two founders of the Hart-Parr Co., sustained the loss of all the buildings and equipment on his large wheat ranch near Hedgesville, Montana, recently.

JOHN T. CHIDSEY, president of the C. J. Root Co., Bristol, Conn., manufacturer of hardware and automatic numbering machines, has been appointed on a committee of the Connecticut Chamber of Commerce to make a complete survey of the freight transportation situation in Connecticut, and to suggest proper adjustment between the railroad, motor truck and other transportation means.

H. C. DORUS has been appointed assistant superintendent of the foundry division of the Yale & Towne Manufacturing Co. Stamford, Conn. He will have charge of the foundries, pattern shop plant, the core department and the cutting-off rooms.

W. M. TAYLOR has recently been appointed assistant superintendent of the mechanical equipment department, of the Yale & Towne Manufacturing Co., Stamford, Conn. Mr. Taylor will have immediate charge of the tool and machine shops of the company.

PAUL K. ROGERS, secretary-treasurer of the Skinner Chuck Co., New Britain, Conn., has been appointed on a committee to make a survey of the freight transportation situation in Connecticut, for the Connecticut Chamber of Commerce.

WILSON S. PORTER, has recently been appointed manager of the Chicago sales office of the Locomobile Company of America, Bridgeport, Conn. Mr. Poerter, was formerly with the Wills-Saint Clair Motor Co.

BARNEY G. ROSS, has returned to the Locomobile Company of America, Bridgeport, Conn., as chief engineer. Mr. Roos was with the Locomobile Company for eight years prior to May, 1920, when he left the company to go with the Timken Axle Co., and in April, 1921, he left there to go with the Pierce-Arrow Motor Co., Buffalo, N. Y., as chief engineer.

E. A. TRAVIS, who has had charge of the New York sales branch of the Locomobile Company of America, Bridgeport, Conn., has returned to the factory and home office in Bridgeport, Conn., as general sales manager.

CLINTON B. AMOROUS, formerly with the Daniels Motor Car Co., has been made sales manager of the New England territory for the Locomobile Company of America, Bridgeport, Conn. Mr. Amorous, will make his headquarters at Boston, Mass.

P. C. RICHTER, superintendent of several departments of the Yale & Towne Manufacturing Co., Stamford, Conn., will also have charge of the industrial electric trucks department and the door closer and hoist departments of the company. The two latter departments have just recently been consolidated.

G. E. OAKLEY, who has been assistant sales manager of the fabricating department of the Bridgeport Brass Co., manufacturer of brass goods, etc., Bridgeport, Conn., has just been chosen sales manager of that division.

G. A. BINZ has been promoted to sales manager of the American Steam Gage and Valve Manufacturing Co., Boston, Mass.

H. S. BENSON has left the employ of the Industrial Company of Boston, Mass., and has purchased the A. T. Thompson Co., manufacturer of optical projection apparatus, Boston, Mass.

THOMAS J. FITZGERALD, in partnership with his brother, M. V. Fitzgerald, has formed the Fitzgerald Forging and Heat Treating Co., Springfield, Mass. Mr. Fitzgerald was formerly vice-president and works manager of the Sturdi Truck Manufacturing Co., Holyoke, Mass.

CHARLES H. KNOWLTON, previously assistant supervisor of air brakes for the C. C. C. & St. L. Ry., has entered the service department of the Simmons-Boardman Publishing Co., New York, N. Y.

H. W. CROSS, formerly district turbine specialist with the General Electric Co., Chicago, Ill., is now with the C. H. Wheeler Manufacturing Co. of Boston, Mass., as district manager.

CHARLES W. STEPHEN, formerly with Pratt & Cady Co., Hartford, Conn., is now employed by the American Chain Co., Inc., Bridgeport, Conn.

Obituary

ROBERT LEWIS, fifty-seven years old, assistant mechanical engineer of the Ohio works of the Carnegie Steel Co., died at Youngsville, Ohio, on Jan. 6, from burns received at the plant.

THOMAS P. EGAN, president of the J. A. Fay & Egan Co., manufacturers of woodworking machinery, died in Cincinnati, Ohio, on Jan. 10. He was seventy-four years old. Mr. Egan was a pioneer in the building of woodworking machinery and was prominent in the trade associations in that field. He was one of the organizers of the National Association of Manufactures and of the Manufacturers Club of Cincinnati.

ROLLIN J. PLUMB, president and director of the Eagle Lock Co., lock and hardware manufacturer, Terryville, Conn., died at his home in Terryville, on Jan. 5, from heart failure. Mr. Plumb was fifty-eight years of age, and had been at the head of the Eagle Lock Co., for over twenty-five years. He was also identified with other manufacturing concerns in Connecticut, among them being the Graham Manufacturing Co., of Derby, Conn., and the Norwalk Lock Co., of South Norwalk, Conn.

AUGUSTUS BOYD, age seventy-three, of Columbus, Ind., died recently in that city. Mr. Boyd became a partner in the Columbus Machine Works seventeen years ago, and since that time had been prominent in business.

Forthcoming Meetings

United Engineering Societies: Annual meeting Jan. 26, Engineering Societies Building, New York City. A. D. Flinn, secretary.

National Association of Manufacturers: Special convention on tariff legislation, Jan. 30 and 31, New Willard Hotel, Washington, D. C. G. S. Boudinot, 50 Church St., New York City, is secretary.

American Boiler Manufacturers' Association: Winter meeting, Feb. 13, Fort Pitt Hotel, Pittsburgh, Pa. H. N. Covell, secretary, 191 Dikeman St., Brooklyn, N. Y.

American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

Export Combine for Automobile Industry—Denby Preaches Optimism

An export combine involving 130 companies which do a domestic business of over one billion dollars annually, was considered by the automobile makers at the Export Manager's Convention of the National Automobile Chamber of Commerce held in New York City on Jan. 10.

The combine, as proposed by G. F. Bauer, secretary of the N. A. C. C. Foreign Trade Committee, would enlarge credit resources and lower the overhead cost of foreign trade in cars and trucks.

The credit of the export combine would be greater than any single company or group. It could investigate the financial rating of foreign buyers at small cost to each individual company. Its resources would permit extending credit to foreign markets on a basis competitive with foreign countries.

Combination would mean much lowered cost per company in documentation, stenographic and translation work, packing offices, ocean insurance, financing and research work. Parts and repair stations could be established abroad on a scale which would be virtually impossible under individual competition.

It is proposed to reduce the cost of the normal competitive function of selling by grouping the participating members in non-competitive classes. That is, each group could contain several automobile companies operating in different price classes which could have one central selling agency, just as in this country a dealer often handles several different makes in different price groups.

Gordon Lee, chief of the automotive division of the Department of Commerce, gave an account of the prompt and practical reports which are now being secured by consuls in the foreign field.

Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, outlined a program for road promotion abroad. Further discussion on roads was led by S. T. Henry of the Allied Machinery Corporation.

Charles S. Wall, executive secretary of the National City Company, spoke on the use of bank acceptances in foreign trade.

Declaring that Washington sees the daylight of better business conditions and that a strong navy is the insurance policy of America. Secretary of the Navy Denby sounded a note of optimism and made a stirring presentation of the value of the naval forces, at the annual banquet held in the Hotel Commodore in the evening.

Eight hundred executives of automobile factories gathered to greet the Secretary at the largest dinner of manufacturers held in the annals of the industry. As Charles Clifton, president of the N. A. C. C. and toastmaster of the evening, introduced the Secretary, bugles sounded the regular navy call, the orchestra played the Star Spangled Banner, the American flag was raised at one end of the room and the Secretary of the Navy's flag at the other end, together with flags of the Navy giving the code for "welcome."

"It is a matter of tremendous pride," said Secretary Denby, "to you and to me to think that through this terrible depression through which our country has been going, the automobile industry has more than won its way and held its own, and now I think we begin to see daylight. That is what we think in Washington, and that is what I think you think."

Irvin S. Cobb was the other speaker of the evening, taking for his topic, "Gasoline, the New National Drink."

Names of automobile makers who received the annual decorations of the industry are as follows: C. H. Wills, president, C. H. Wills & Co.; Howard C. Marmon, president, Nordyke & Marmon Co.; George M. Graham, vice-president, Chandler Motor Car Co., Edward S. Jordan, president, Jordan Motor Car Co.; A. R. Erskine, president, Studebaker Corporation.

The Trend of Business Improvement—Plants Resuming

The Advance Stove Works, Evansville, Ind., is arranging for the immediate resumption of operations at its plant, giving employment to about seventy-five men. The plant has been closed for some time past.

The Pierce Arrow Motor Car Co., Buffalo, N. Y., has increased operations to the extent of giving employment to about 3,200 men, as compared with 1,800 operatives a few months ago.

The Southern Railroad Co. has increased the working force at its shops at Princeton, Ind., to approximately 270 men, or well over one-half of normal. Approximately seventy men have been added to the force during the past few weeks.

The Slatington Iron and Steel Co., Slatington, Pa., is arranging for the early resumption of production at its mill, following a shut down for a number of months past. Robert Grant, Woolworth Building, New York, heads the company.

The Milton Manufacturing Co., Milton, Pa., manufacturer of nuts, etc., has resumed operations at its electric steel department, following a shut down of a number of months.

The Southern Stove Works, Evansville, Ind., is arranging for immediate resumption of production at its plant, following a short shut down primarily for inventory purposes.

The Shaw Crane Co., Muskegon, Mich., is increasing the working force at its plant by about 60 per cent.

The Texas and Pacific Railroad Co. has resumed operations at its shops at Marshall, Tex., following a shut down of several months.

The Freeland Bobbin Works, Freeland, Pa., manufacturer of textile equipment, is arranging for the early resumption of operations, following a shut down of a number of months.

The Crescent Stove Works, Evansville, Ind., is preparing for the resumption of operations at its plant. A working force of about 110 men will be employed.

The Ford Motor Co., Detroit, Mich., has resumed operations in all departments of its local plant, following a curtailment since Dec. 21, for inventory. Work will also be resumed at an early date at the Kearney, N. J., assembling plant of the company.

The Richardson & Boynton Co., Dover, N. J., manufacturer of stoves, ranges, etc., has re-opened its plant under a reduced wage schedule.

The Continental Motors Corporation, Muskegon, Mich., manufacturer of automobile engines, is increasing the working force at its plant for greater production.

The Boston & Albany Railroad Co., Boston, Mass., has resumed operations at its shops at West Springfield, Mass., following a shutdown of about two weeks. Employment will be given to about 400 men.

The Buick Motor Co., Flint, Mich., manufacturer of automobiles, resumed operations at its plant on Jan. 9, under a full time schedule, following a shutdown since Dec. 23, primarily for inventory.

The Chicago Bridge & Iron Works, Chicago, Ill., has added a night shift to the working force at its Greenville, Pa., plant. Work is being concentrated on steel fabrication for tank manufacture.

The United States Gas Machine and Pattern Co., Muskegon, Mich., has increased the working force at its plant about 50 per cent.

The International Harvester Co., Chicago, Ill., is adding machinists at its plant at Akron, Ohio, and is also increasing the working force in other departments. It is proposed to adopt an operating schedule of close to fifty farm tractors a day at an early date.

The Chesapeake & Ohio Railroad Co., has resumed operations at its shops at Huntington, W. Va., giving employment to about 1,200 men. The plant was closed on Dec. 17, and has been idle since that time.

The Pullman Co., Chicago, Ill., is increasing the working force at its car works at Wilmington, Del., taking back a number of men recently laid off. About 600 men are being employed on full time.

The United States Steel Products Co., a subsidiary of the United States Steel Corporation, has taken an order for about 13,000 tons of steel rails for the Japanese government. The manufacture will be carried out at the plant of the Tennessee Coal and Iron Co., a subsidiary, at Ensley, Ala.

The Chicago, Burlington & Quincy Railroad Co., Chicago, Ill., will purchase about 7,300 new freight cars and 127 passenger cars, estimated to cost about $15,000,000. This amount has been appropriated for the rolling stock.

Expect Tariff Legislation This Month

Unquestionably an earnest effort is being made by the Finance Committee of the Senate to report out the tariff bill at the earliest moment. Some of the Republican leaders, however, continue to be of the opinion that this is no time to attempt a permanent revision of the tariff and prefer to see the bill delayed still further.

The probabilities seem to be that the committee will be allowed to have its way and it will report out a bill before the end of January. While it is known that there will be material changes in the House bill, including a material reduction in the level of most rates, no definite information as to the plans has gone out from the committee. The committee is supporting American valuation, but it is very apparent that it is beset with uncertainties as to the practical application of that plan.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Cal., San Diego — The Coburn Machine Co., 2nd and G Sts.—one 16 in. tool lathe.

Conn., Meriden—C. E. Miller, 27 Pleasant St.—one small lathe, (used).

Ill., Chicago—The Streets Co., West 48th and South Morgan Sts.—

One single end punch 60 in. throat with triple gag socket 1 x 1 and motor for punching steel car floor and side sheets.

One single end multiple punch with sufficient depth throat and hand operated spacing table and provided with gag sockets for punching of long angles, cover plates, etc., and motor.

One horizontal punch and motor 15 in. throat capacity 1 x 1 for punching miscellaneous parts and odd shapes.

One heavy duty punch and shear and motor, capacity 2½ x 1½ provided with coping tool for punching, shearing and slotting heavy channel sections, etc.

Two single end punches and motors provided with triple gag sockets 15 in throat capacity 1½ x 1 for punching "I" beams, channels, etc.

One multiple punch and motor, capacity 600 ton, two row punching outfit with adjustable bolsters or punch holders, 12 ft. 6 in. length of ram, 10 ft. 2 in. between housings.

One double end punch and shear and motor, 24 in. throat to punch 1½ in. hole in 1 in. thick material and for shearing long flats and rounds, 2 in. diameter and 6 x 1 in. flats, shear blades placed lengthwise of machine.

One single end punch and shear and motor 48 in. throat to punch 2 in. hole in 1 in. thick material and for shearing 2½ in. rounds and 8 x 1 in. flat bars, shear blades placed lengthwise of machine.

One heavy bulldozer and motor sufficient capacity to form diaphragms and other parts of heavy car material, capacity approximately 300 ton last one inch of stroke.

One bulldozer and motor, face of cross head approximately 16 in. x 70 in. capacity, 390,000 lb. developed last one inch of stroke.

One 300 ton hydraulic press complete with pump, accumulator etc.

One heavy duty drill press and motor for drilling heavy material, capacity approximately 2½ in. to 3 in. hole.

One 16 in. engine lathe and motor approximately 8 to 10 ft. long.

Two double end car axle lathes and motors to take a 6 x 11 in. A. R. A. axle.

One 300 ton car wheel and axle, press and motor to take a 6 in. x 11 in. A. R. A. axle.

Two emery wheel stands and motors suitable for universal grinding.

Two single head or single spindle drill presses and motors to drill all sizes of holes up to 2 in. in diameter, inclusive.

One 4 spindle drill press and motor to drill all sizes of holes up to 2 in. in diameter, inclusive, also suitable for drilling arch bars.

One 12 ft. x ¾ in. bending brake and motor for flanging steel car floor plates, end plates, etc.

One eye bender and motor to take stock, 1½ in. diameter bent hot around a 2½ in. mandrel.

One 1,500 lb. steam hammer.

One automatic hack saw and motor to cut all sizes of material up to 7 in. x 8 in.

One 10 ton electric overhead traveling crane with magnet, 50 ft. long center to center of crane rails to runway over stripping tracks.

Two overhead electric traveling cranes 10 ton capacity, 90 ft. long center to center of crane rails.

One plate shear and motor for shearing and squaring plates used in steel car construction approximately ¾ x 144 in.

One 3 in. single head threading machine and motor including dies for bolts and pipe and taps from 1 in. to 3 in. both inclusive.

Two 2 in. triple head bolt cutters and motors including necessary pumps and dies to cut all sizes of bolts from ¾ in. to 2 in. both inclusive.

One 2 in. 6-spindle nut tapper and motor including pumps and taps from ¾ in. to 2 in. both inclusive.

One large blower and motor sufficient to take care of 6 blacksmith fires.

One 2½ in. upsetting or forging machine and motor.

Two bolt headers and motors, one ¾ in. and one 1½ in.

One medium size engine shaper and motor for handling tools used in steel car work.

One Alligator shear for scrap dock for shearing scrap metal parts, approximately 8 x 1½ in. flats and 3 in. rounds.

One grindstone standard size and motor.

Two 200 lb. Bradley Helve hammers and motors.

Ill., Galesburg—Meyer & Foley Co.—one 14 in. or 16 in. geared crank shaper, (used if in good condition).

Ind., Indianapolis — The Indianapolis & Cincinnati Traction Co., Germania Bldg., C. Henry, Pres.—machine shop machinery, tools, drill, presses and lathes, anvils, trip hammers and wheel presses for proposed machine shop at Cincinnati, O.

Ind., Wabash—The Service Motor Truck Co.—four gear hobbing machines for spur and spiral gears, 2 in. to 15 in. diameter; four 20 in. Bevel gear planners; six National automatic Acme screw machines; three plain grinders; five cylinder grinders and six crankshaft grinders.

Mass., Easthampton—The Easthampton Motors Co., 46 Union St.—one 20 in. upright drill, Barnes preferred (used).

N. Y., Buffalo—F. Albig, 681 Sycamore St.—tin-smith machinery.

N. Y., New York—H. W. Johns-Manville Co., Madison Ave. and 41st St.—two sensitive drills, two emery grinders, two 20 in. upright drills, one No. 1 universal grinder, one 60 in. knife grinder one 20 in. shaper, one pipe machine, one 30 in. open side planer and one 9 in. hack saw.

N. Y., New York—The Manhattan Wire Frame Co., 398 1st Ave.—two welding machines.

N. C., Greensboro—The Greensboro Supply Co.—air compressor, punches and shears.

N. C., Wilmington—Carters Production Wks. 210 South Water St., O. Carter, Purch. Agt.—one 20 in. floor type lever feed press. (send specifications, price and cut, if possible).

N. C., North Wilkesboro—The New William Mill Co., B. L. Johnson, Purch Agt.—one lock corner machine for cutting ¾ in. lumber ¾ in. thick, 6 to 10 in. wide, (new or used), also a machine for making wire shapes.

O., Cleveland—The Engineering Construction Co., 778 The Arcade—one large air compressor.

O. Columbus—J. W. Brazier Buttles and Factory Sts.—metal working machinery.

O., Columbus—The Central Machine & Tool Co., 208 East Rich St., C. Haydon, Mgr.—machine tools including lathe, grinder and press.

O., Columbus—The Fisher Box Co., 1629 McKinley Ave., O. M. Fisher, owner, wood working machinery.

O., Columbus—The Mathews Lumber & Mfg. Co., 500 South Central Ave., W. A. Mathews, Pres.—woodworking machinery including saws, planers, etc.

Ore., Enterprise—H. E. Walker, P. O. Box 342—catalogues for mining machinery and sawmill.

Pa., Harrisburg—The Harrisburg Machine & Electric Welding Co., 18th and Chestnut Sts., A. A. Hayward, Mgr.—several electric welding machines and grinding machine for grinding engine cylinders.

Pa., Phila.—The Morice Twine Mills, 84 Tasker St., J. H. Morice, Pres.—comber, shuttles and general machinery for twine factory.

Pa., Pittsburgh—T. J. Ward, 333 Carson St.—woodworking lathe with motor, small drill press, woodworking tools and emery wheel (used).

S. D., Brookings—The South Dakota State College, Dept. of Civil Engineering, D. L. Snader, C. E. M. S.—one concrete beam testing machine of size to take fairly large size beams.

Tenn., Fayetteville—The Keethler Quarries, T. Keethler, owner—one 100 ton daily capacity jaw crusher, one 150 ton daily capacity gyratory crusher, one pulverizer (to pulverize limestone) and several conveyors.

Tenn., Nashville—The Baxter Marble & Limestone Co., 638 Stahlman Bldg., Address A. J. Bright, Ch. Engr.—conveyors and pulverizers for pulverizing limestone for agriculture purposes.

Tenn., Nashville—The Rock Asphalt Bldg., Block Co., 638 Stahlman Bldg., A. J. Bright, Ch. Engr.—one Gyratory crusher 150 ton daily capacity; one 16 ft. x 40 in. revolving screen with dust jacket; one 30 ft. belt and elevator buckets for same; one 24 in. x 24 in. friction hoist; one pulverizer for pulverizing limestone for agriculture purposes; shafting belts and pulleys, etct.

W. Va., Huntington—The Landstreet Downey Coal Co., R. & P. Bldg., C. P. Downey, Jr., Genl. Mgr.—machinery, hoisting equipment, mining locomotive, undercutting machines and motors, for mines at Burch.

Wis., Cedar Falls—(R. D. Menomonie) —Houghtaling & Houghtaling grist mill machinery operated by gasoline engine or motor power.

Wis., Eau Claire—Eau Claire County, c/o G. Osborne, Highway Comr.—grinder and lathe suitable for repairing road machinery.

Wis., Fond-du-Lac — The Combination Door Co., 180 Ruggles St., L. Schmidt, Pres. —woodworking machinery for proposed door factory.

The Weekly Price Guide

This Week's Market

Structural shapes, plates and bars, at the Pittsburgh mills, continue at $1.50 per 100 lb. Mill shipments, New York, of steel shapes and bars are quoted at $1.88; plates at $1.83@$1.88. Although mill prices hold firmly, warehouse quotations in New York and Cleveland show a downward trend. Cold finished shafting is quoted in New York at $3.45 as against $3.55 and flats, squares and hexagons at $3.95 as compared with the former price of $4.05 per 100 lb. Cleveland reports a reduction of 15c. on hoop steel, shapes, plates and bars; 25c. per 100 lb. on cold finished shafting and flats, squares, etc.

Copper, lead and spelter markets quiet with slightly improved demand for tin, giving rise to quotations as high as 33¼c., but averaging 33c. per lb. in the New York warehouses.

Linseed oil is quoted in New York at 73c. as against 72c. per gal., in 5-bbl. lots; prices firm in Cleveland and Chicago.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$21.50
Northern Basic	22.02
Southern Ohio No. 2	22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	27.50
BIRMINGHAM	
No. 2 Foundry	17.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	21.26
Virginia No. 2	28.74
Basic	20.25
Grey Forge	22.00
CHICAGO	
No. 2 Foundry local	20.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	20.21
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.30	3.33	3.15	3.43
No. 14	2.35	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	BUTT WELD Inches	Iron Black	Galv.
1 to 3	71	58½	¾ to 1½	44½	29½
			LAP WELD		
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
			BUTT WELD, EXTRA STRONG, PLAIN ENDS		
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
			LAP WELD, EXTRA STRONG, PLAIN ENDS		
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	3.78
Spring steel (light) (base)	6.00	6.00	....
Coppered Bessemer rods (base)	7.00	8.00	5.88
Hoop steel	3.38	2.96	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.60	....	4.98
Cold finished shafting or screw	3.45	3.25	3.40
Cold finished flats, squares	3.95	3.75	3.90
Structural shapes (base)	2.63	2.46	2.88
Soft steel bars (base)	2.53	2.36	2.78
Soft steel bar shapes (base)	2.53	2.36	2.78
Soft steel bands (base)	3.13	....	3.48
Tank plates (base)	2.63	2.46	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/32	8.50		12@13
1/8	7.15		11@12
5/32 to 1/4	6.75		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			14.37½
Tin, 5-ton lots, New York			33.00
Lead (up to carlots), St. Louis, 4.60; New York			5.00
Zinc (up to carlots), St. Louis, 5.10; New York			5.50
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.50	6.75
Copper sheets, base	21.25	22.00	23.00
Copper wire (carlots)	15@15.25	17.00	16.25
Copper rods (ton lots)	19.75	24.00	19.50
Copper tubing (100-lb. lots)	21.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	17.00	18.75
Brass tubing (100-lb. lots)	18.50	19.50	20.50
Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Zinc sheets (casks), (8% dis. carlots)	10.50	10.65	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	19.00	23.70	19.25
Babbitt metal (best grade)	33.00	42.50	36.00
Babbitt metal (commercial)	16.00	13.50	9.00

—Shop Materials and Supplies

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.25	11.50	11.00
Copper, heavy, and wire	11.00	11.00	10.00
Copper, light, and bottoms	9.50	9.00	8.75
Lead, heavy	4.00	3.75	3.50
Lead, tea	3.00	2.75	3.00
Brass, heavy	7.00	6.50	8.50
Brass, light	5.00	4.50	5.00
No. 1 yellow brass turnings	5.75	5.50	5.75
Zinc	3.00	2.50	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	22.50	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	12.00	14.50
IC,	112 sheets	12.80	12.30	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	.....	50.00	55.00
Wiping cloths per M., 13¼x20½	.....	55.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.73	.76	.74
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag	.....	.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$2.75@$3.00	
Coke, prompt foundry, Connellsville	per net ton	3.75@ 4.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	60-5%	60%	60-10-10%
1¼ and 1¼x3 in. up to 12 in.	50%	60-10-10%	60-10%
With cold punched sq. nuts	50%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	55%	.....	$4.00 off
Button head bolts, with hex. nuts	35%	$3.90 net	.....
Hex. head and hex. nut bolts	40%	.....	65-5%
Lag screws, coach screws	65%	.....	60%
Carriage bolts, up to 1 in. x 30 in.	50-10%	50-10-10%	50-5%
Bolt ends, with hot pressed nuts	60%	.....	55%
Tap bolts, hex. heads	25%	.....	.....
Semi-finished nuts ⅜ and larger	75%	75%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$4.50	$5.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	3.75	3.75	3.50
Washers, round plate, per 100 lb. Off list	4.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	3.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	3.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	3.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	3.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	60-5%	60-10-10%	65-5%
Rivets, tinned	60-5%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.50	3.50	3.43
Cone heads, ditto (net)	3.60	3.60	3.53
1⅛ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$4.03 base
Copper rivets	60-5%	40-10%	50-10%
Copper burs	40%	15%	10%
Lard oil, pure, (50 gal. bbl.) per gal.	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50-5%	50-5%	60-10%
Medium grade	45%	40-10-2½%	50%
Heavy grade	40%	40%	40-5%
Rubber and duck:			
First grade	50-10%	50-10%	.....
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$6.16	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	29.48	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100. Paper	1.32	.....	1.49
Cloth	3.20	.....	3.20

Wis., Fond-du-Lac—D. C. Sargent, 29 South Main St.—mangiers, wash machines and tumblers, all power driven for laundry purposes.

Wis., Hartford — Gehl Bros. Monument Co.—stone crushing machinery, for proposed marble factory on North Main St.

Wis., Hurley — The Raiveri & Norman Motor Co.—auto repair shop equipment, presses and lathe.

Wis., La Crosse—The Tri State Monument Co., 624 South 17th St., E. L. Halmrast, Purch. Agt.—granite and marble cutting machinery.

Wis., Milwaukee—The Auto Service & Repair Station 383, 5th St.—electric drills.

Wis., Milwaukee—Froelick Bros., 799 7th St.—lathe, and grinder suitable for garage use.

Wis., Milwaukee—Matt & Son, 1137 Grant Blvd., F. Matt, Purch. Agt.—one planer.

Wis., Milwaukee—J. Opstad, 975 35th St. —band saw and planer.

Wis. Milwaukee—F. Toepfer Sons 460 National Ave., F. Toepfer Purch. Agt.—one grinder, one 14 in. or 16 in. lathe, air compressor and electric motors.

Wis., Oconomowoc—The Hurtgen Dairy Co.—ice machine, refrigeration, butter and probably ice cream making machinery.

Wis., Plymouth—The Badger Cabinet Co., G. W. Brickbauer, Pres.—woodworking machinery for proposed chair factory.

Wis., Prairie-du-Chien—J. W. Paris—three carding machines, motor power.

Wis., Racine—Bondgard & Christensen, 2222 Kinzie Ave.—woodworking machinery for proposed plant on Mound St.

Wis., Spencer—The Spencer Condensary Co., c/o E. Buss, Marion—dairy and refrigerating machinery for proposed dairy on Main St. here.

Wis., Stevens Point — The Buick Sales Room, 119 Strongs Ave., R. E. Newby, Mgr.—gas storage tanks and pumps.

Ont., Collingwood—The Gourlay Shoe Co. —complete equipment for shoe factory.

Ont., London—B. F. Brighton, 479 Emery St.—complete modern equipment for bakery.

Ont., London—The Ontario Creameries Co., Ltd., 129 King St.—complete refrigeration and ice cream making equipment. Estimated cost, $30,000.

Metal Working Shops

Cal., Porterville—The Porterville Union High School Dist., receiving bids for the construction of a high school. Estimated cost, $270,000. Bids will be received later for shops, etc. Coates & Travers, Rowell Bldg., Fresno, Archts.

Cal., San Francisco — A. Livemuis, 1625 Pacific Ave., plans to build a 1 story automobile repair shop on Pacific Ave., west of Larkin St. O'Brien Bros., Inc., 240 Montgomery St., Archts.

Ill., Chicago—The Newberry Library, c/o Mundie & Jensen, archts., 39 South LaSalle St., has awarded the contract for the construction of a 1 story, 75 x 100 ft. garage at 215-219 West Erie St. Estimated cost, $40,000. Noted Nov. 17.

Ind., Indianapolis — The Interstate Car Co., Sherman Drive and Massachusetts Ave., has awarded the contract for the construction of a 2 story, 50 x 110 ft. car factory. Estimated cost, $25,000. Noted Jan. 6.

Ind., Indianapolis — The Reedy Elevator Co., 1026 Kentucky Ave., is having plans prepared for the construction of a 1 story, 45 x 202 ft. elevator factory on South New Jersey St. Estimated cost, $40,000. R. N. Edwards Co., 45 Union Trust Bldg., Archts.

Mass., Palmer—M. H. Davitt, 525 North Main St., plans to build a 1 story garage, etc. Estimated cost, $40,000. Architect not selected.

Md., Baltimore—J. I. Lealmear, 1108 Fidelity Bldg., is having plans prepared for the construction of a 2 story garage. C. H. Heblancke, 3401 Fairview Ave., Archt.

Md., Baltimore—M. N. Tumbler, Wolf Bldg., is receiving bids for the construction of a 1 story garage at 2567 Penna. Ave. Estimated cost, $40,000. W. J. Degenhardt, 917 East Preston St., Archt.

Md., Baltimore—The Wilson Nash Motors Co., 134 West Mt. Royal Ave., is receiving bids for the construction of a 1 story, 120 x 150 ft. garage on Maryland Ave. and Oliver St. Owens & Sisco, Continental Bldg., Archts.

Md., Bridewell (Jessups P. O.) — The Maryland House of Correction, State Bd. of Prison Control, Union Trust Bldg., Baltimore, is having plans prepared for the construction of a 2 story, 45 x 150 ft. shop, here. Estimated cost, $40,000. T. W. Pietsch, Amer. Bldg., Baltimore, Archt.

Mich., Detroit—The Gagnier Stereotype Co., 525 Howard St., is having plans prepared for the construction of a 1 story, 30 x 700 ft. stereotype factory on McKinstry and Plumer Sts. Estimated cost, $75,000. J. Kasurin, 512 Empire Bldg., Archt.

Mo., St. Louis—G. G. Hoffman Magneto Co., 3932 Olive St., is having plans prepared for the construction of a 1 story, 100 x 234 ft. sales room, garage and service station at 3892 Washington St. Estimated cost, $50,000. S. G. Hoffman, Pres. E. Lantz, 600 Post Dispatch Bldg., Archt.

Mont., Bozeman—The State Bd. of Examiners, Helena, will receive bids until Jan. 21 for the construction of a 4 story, 77 x 198 ft. engineering building and a 1 story, 119 x 182 ft. engineering shop for the University of Montana, here. Estimated cost, $225,000 and $100,000 respectively. F. F. Wilson, Owenhouse Bldg., archt.

N. Y., New York—W. M. W. Realty Corp., 116 West 39th St., will build a 2 story, 100 x 100 ft. garage at 841 10th Ave. Estimated cost, $65,000.

O., Cincinnati—The Indianapolis & Cincinnati Traction Co., Germania Bldg., Indianapolis, Ind., plans to build a machine shop, here. C. Henry, Pres.

O., Cleveland—W. Lintern, 8404 Lorain Ave., has awarded the contract for the construction of a 1 story, 60 x 64 ft. factory at 7966 Lorain Ave., for the manufacture of railway supplies. Estimated cost, $40,000.

O., Cleveland—S. Wahl, 799 East 103rd St., is receiving bids for the construction of a 1 story, 56 x 145 ft. garage and commercial building at 8116 Lorain Ave. Estimated cost, $50,000. Private plans.

Pa., Cheswick—The Stonecrete Corp., 6023 Pennsylvania Ave., Pittsburgh, will build a 2 story factory and machine shop, near here. Private plans.

Pa., Harrisburg—E. R. Gelsinger, plans to build a 2 story, 50 x 100 ft. garage on 28th and Main Sts. Estimated cost, $50,000.

Tex., Denison—The Missouri, Kansas & Texas Ry., Railway Bldg., St. Louis, Mo., has awarded the contract for the construction of a freight terminal here, consisting of switching yards, round house, warehouse, shops and other buildings. Estimated cost, $3,000,000. F. Ringer, Ch. Engr. Noted Jan. 12.

Wis., Hurley — The Raiveri & Norman Motor Co., has selected a site and plans to build a 2 story, 50 x 140 ft. garage and repair shop. Estimated cost, $60,000. Architect not selected.

Wis., Stevens Point—The Buick Sales Room, 119 Strongs Ave., plans to build a 1 story, 70 x 125 ft. garage on Main St. Estimated cost, $40,000. Architect not selected.

General Manufacturing

Cal., Santa Ana—The Excelsior Dairy Co., has awarded the contract for the construction of a 1 story, 60 x 240 ft. factory and storage plant. Estimated cost, $50,000.

Cal., Los Angeles—Bedell & Ogg Laundry Co. has awarded the contract for the construction of a 1 story, 110 x 120 ft. laundry. Estimated cost, $50,000.

Cal., Oakland—The Sanitary Ice & Cold Storage Co., 26th and Chestnut Sts., has awarded the contract for the construction of a 1 story ice plant on 26th St. east of Chestnut St. Estimated cost, $11,500.

Ill., Clearing—The Railways Ice Co., 209 South LaSalle St., Chicago, has awarded the contract for the construction of a 2 story, 100 x 150 ft. ice factory, here. Estimated cos, $120,000.

Ill., Henry—The Henry Artificial Ice Co., will build a 1 story ice plant. Estimated cost, $30,000. C N. Lucas, Pres. Noted Dec. 22.

Ill., Rockford—The Rockford Show Case Co., Elm St., has awarded the contract for the construction of a 3 story, 40 x 68 ft. factory.

Ind., Bloomington — The Bloomington Brick & Tile Co., plans to build a plant. Estimated cost, $200,000. Private plans.

Ind., Bloomington—The Johnson Creamery Co., is having plans prepared for the construction of a 2 story, 50 x 87 ft. addition to its plant. Estimated cost, $40,000. A. E. Neucks, 515 Woods Bldg., Evansville, Archt.

Ind., Elkhart—The Superior Coal Co. is having plans prepared for the construction of a 2 story, 45 x 83 ft. ice plant. Estimated cost, $10,000. R. L. Simmons, 201 South Main St., Archt.

Ind., Garrett—The Garrett Ice Co., Inc. plans to build an ice plant. Estimated cost, $40,000. Private plans.

Ind., Gary—The Superior Sausage Co., plans to build a 1 story, 75 x 100 ft. factory. Estimated cost, $10,000. J. M. LeVee, 673 Bway., Archt.

Ind., Indianapolis — The Indiana Sawed Veneer Co., 324 West 14th St., has awarded the contract for the construction of a 1 story, 90 x 110 ft. veneer factory at 340 West 14th St. Estimated cost, $24,000. Noted Dec. 15.

Ind., Lebanon—N. N. Smith Co., 407 Main St., Frankfort, has awarded the contract for the construction of a 2 story, 38 x 110 ft. cigar factory and office building here. Estimated cost, $25,000. Noted Jan. 6.

Ind., Mishawaka—The Lock Joint Tube Co. has awarded the contract for the construction of a 1 story, 45 x 90 ft. tubing factory. Estimated cost, $30,000. Noted Dec. 22.

Ind., Rochester—Armour & Co., 208 South LaSalle St., Chicago, is having plans prepared for the construction of a 2 story, 100 x 150 ft. packing plant, here. Estimated cost, $75,000. Private plans.

Mass., West Springfield—P. Fossa, 98 Old Bridge St. plans to build a 1 story, 100 x 120 ft. ice cream plant on Old Bridge St. Architect not selected.

Md., Baltimore—The Amer. Concrete Ties & Products Co., 426 Law Bldg., plans to build a factory. Private plans.

Md., Baltimore—The Amer. Woodworking Co., is having preliminary plans prepared for the construction of a planing mill at 5 Uhler St. Estimated cost, $20,000. R. C. Pratt, 325 North Charles St., Archt.

Mo., Cape Girardeau—The International Shoe Co., Washington St., St. Louis, has awarded the contract for the construction of a 3 story shoe factory, here. Estimated cost, $100,000. Noted Dec. 22.

Mo., St. Clair—The International Shoe Co., 15th and Washington Sts., St. Louis, will build a 3 story shoe factory here. Estimated cost, $75,000. Noted Jan. 6.

Mont., Miles City—The Western Creamery Co., 1215 Main St., plans to build a creamery. Estimated cost, $100,000. F. R. Merrill, Mgr. Architect not announced.

N. C., Lenoir — The Union Mirror Co. plans to build a mirror factory. Architect not selected.

N. C., Winston-Salem—W. C. Northup, Engr., Winston-Salem, will open bids latter part of this month for the construction of a 5 story hospital, including laundry, etc., for the State Baptist Convenion. Estimated cost, $2,000,000.

O., Columbus—J. H. and F. A. Sells Co., Chestnut and Pearl Sts., manufacturers of horse collars, plans to construct a 3 story collar factory on Grant Ave. Estimated cost, $35,000. Architect not selected.

Ore., Portland — Rasmussen & Grace, Engrs., Chamber of Commerce Bldg., will open bids about Jan. 25 for the construction of a 3 story, 100 x 100 ft. publishing plant on 11th and Washington Sts., for the Telegram Publishing Co., Washington and Park Sts. Estimated cost, $150,000.

Pa., Harrisburg—The United Ice & Coal Co., Forster and Cowden Sts., has had plans prepared for the construction of a 100 ton daily capacity ice plant and three 5,000 ton capacity storage houses, two on 7th and Schuylkill Sts. and one on Forster and Cowden Sts. Estimated cost, $150,000.

Pa., Wellsboro—The Pennsylvania Textile Co. will soon award the contract for the construction of a 50 x 250 ft. textile mill Estimated cost, $300,000. Scott & Prescott, 34 East 23rd St., New York City, Archts. and Engrs.

W. Va., Charleston—The Diamond Ice & Coal Co., 807 Kanawha St., will build a 2 story, 100 x 100 ft. ice plant. Estimated cost, $50,000.

W. Va., Morgantown—R. A. Wilbourne Co. will soon award the contract for the construction of a 3 story 36 x 160 ft. addition to its ice cream plant. Estimated cost, $55,000. C. Reger, Traction Bldg., Archt.

Wis., Hartford — Gehl Bros. Monument Co. is having plans prepared for the construction of a 2 story, 42 x 106 ft. marble factory on North Main St. Estimated cost, $65,000. Private plans.

Wis., Hortonville—W. L. Schraeder will build a 1 story, 50 x 120 ft. canning plant. Estimated cost, $50,000.